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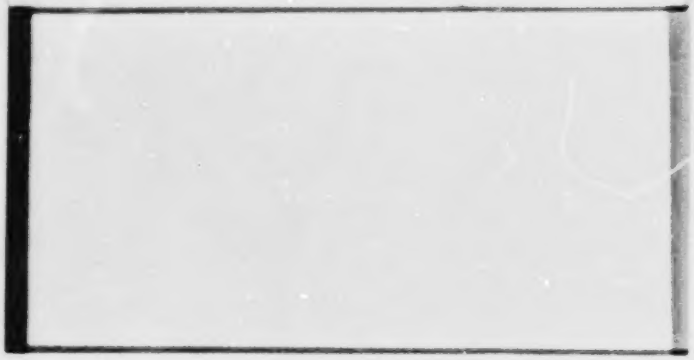

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BRUCE GS 'B'
PREOPERATIONAL BIOLOGICAL STUDY
YEAR II - 1980-81

Report No 82-205-K

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Chemical Research Department

ABSTRACT

The second year of Bruce GS 'B' preoperational study was conducted between May 1980 and March 1981. Substrate in the study area was heterogeneous consisting primarily of bedrock with areas of cobble and boulder. Sediment accumulation in traps was greatest at the 7 m depth rather than the 3 and 12 m depths and along the Holmes Bay transect. Measured water quality parameters were indicative of an unpolluted environment with a dissolved solids to conductivity ratio typical of water free of industrial waste. Trends in water quality parameter levels were seasonal rather than spatial. Rainbow smelt and alewife were the predominant fish larvae collected in Holmes Bay and Inverhuron Bay. Smelt larvae density was highest on May 23 and that of alewife was highest in late July. Spottail shiner was the most abundant fish caught in beach seines with highest catches at Gunn Point in August. Trap nets captured mainly long-nose suckers with highest numbers caught at McRae Point in June. Alewife was the main species collected in gill nets and was most abundant at Gunn Point in July. Round whitefish were collected by gill net in September, October and November. Maximum catches were in nets set

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740634-120-000	837.321 BRU	January 28, 1983	82-205-K

at the 12 m depth in September and at the 3 m depth in October and November. Post-spawn individuals were collected in November at Gunn Point and McRae Point. Gizzard shad was the predominant fish species collected in the winter fish survey. No larid nests were located on the Bruce 'B' site.

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To Dr. W.R. Effer
Manager
Environmental Studies and Assessments
Design and Development Division
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BRUCE GS 'B' PREOPERATIONAL BIOLOGICAL STUDY YEAR II - 1980-1981

1.0 INTRODUCTION

1.1 Objective

The second of three years of precperational biological studies at Bruce GS 'B' was conducted in 1980 through April 1981. The studies, requested by Environmental Studies and Assessments, Design and Development Division, were designed to describe the spatial and temporal variability in the physical, chemical and biological characteristics of the nearshore environment of Lake Huron near the Bruce GS 'B' site.

The information collected during this study along with the information collected in the first and third years will eventually be compared with similar studies to be conducted during the operation of the station in order to identify changes in the aquatic environment which may have resulted from station operation.

During the study period construction of the station was proceeding, however, work was limited to on shore development with no shoreline modification.

1.2 Study Area

The study area and sampling locations are illustrated in Figures 1.2-1 and 1.2-2. The area is similar to that utilized in 1979 with the additional inclusion of two transects in Inverhuron Bay and McRae Point.

The frequency of sampling is presented in Table 1.2-1.

2.0 METHODS

2.1 Physical Characteristics

2.1.1 Substrate

SCUBA divers equipped with an underwater 35 mm camera photographed

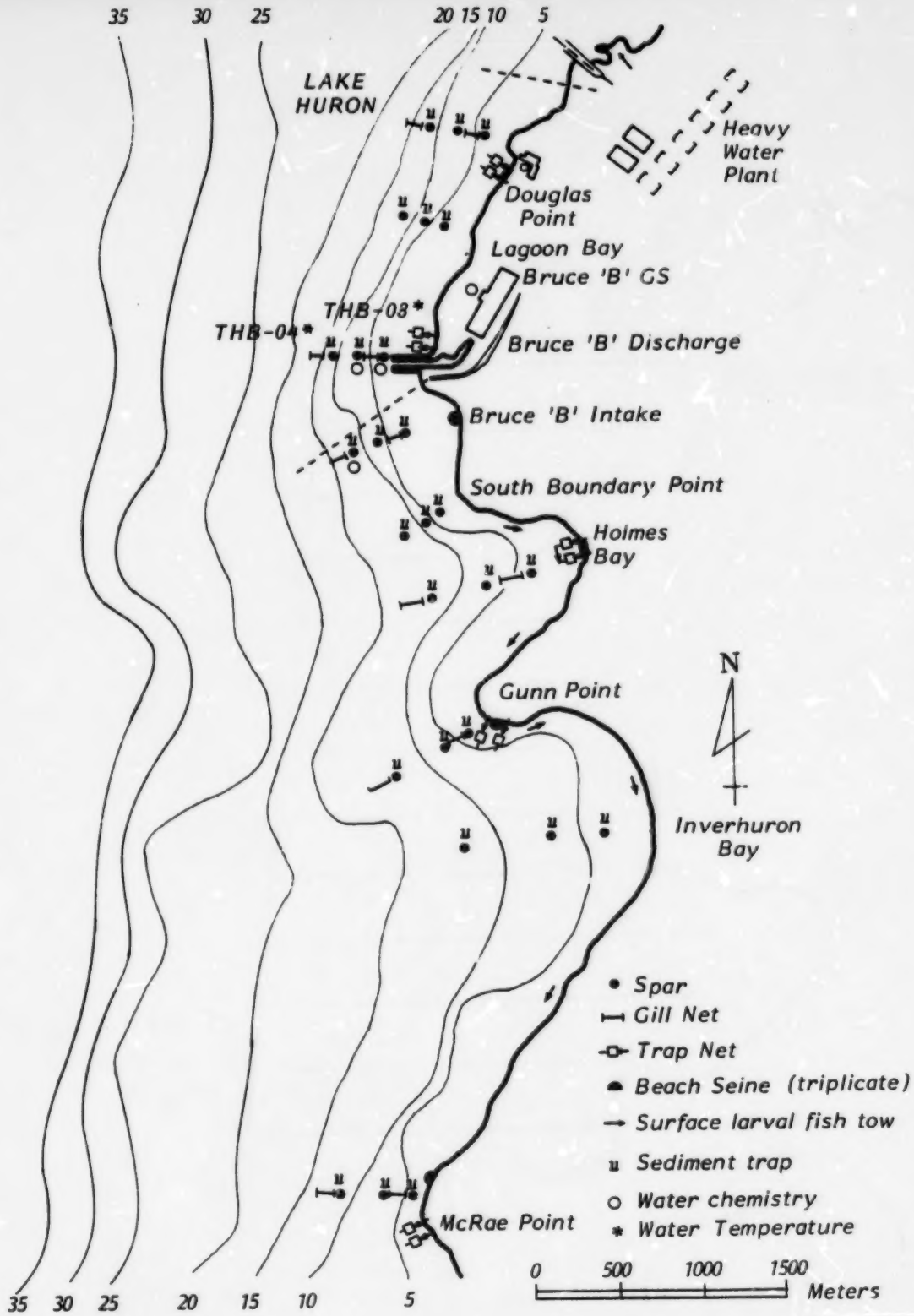

FIGURE 1.2-1

SAMPLING LOCATIONS AND TYPES OF SAMPLES TAKEN
BRUCE 'B' GS

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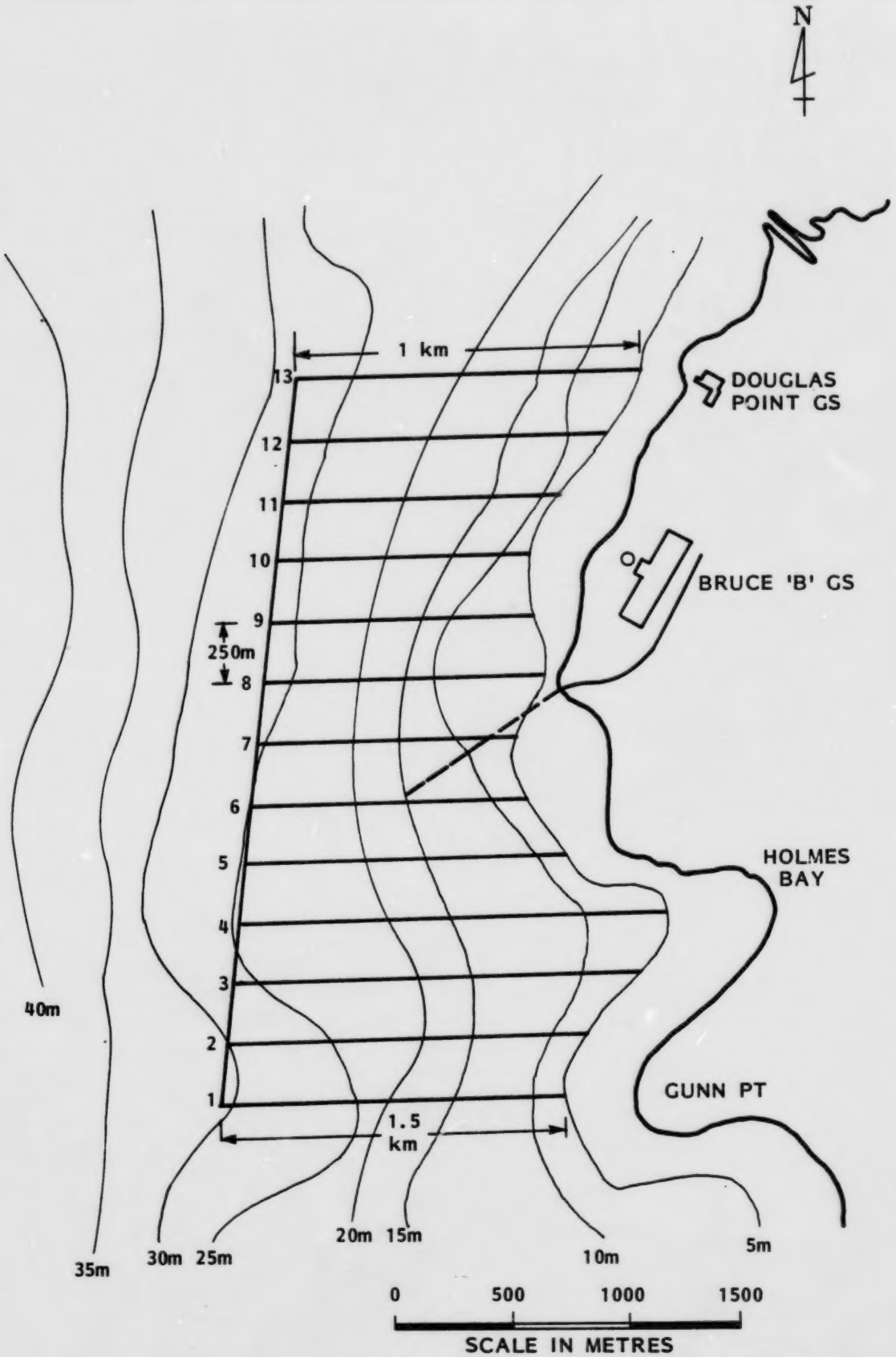


FIGURE 1.2-2

ACOUSTIC FISH CENSUS GRID AT BRUCE 'B' GS, 1980
(APPROXIMATE TRANSECTS LENGTHS)

155787-RD

TABLE 1.2-1

Sampling Schedule Bruce GS 'B'

1980-1981

		Month										
		M	J	J	A	S	O	N	D	J	F	M
1)	Substrate Map (photography)				X							
2)	Sediment Traps	X		X		X		X				
3)	Water Chemistry	X	X	X	X	X	X					
4)	Ichthyoplankton (weekly)	XXXXXXX										
5)	Adult and Juvenile Fish	X	X	X	X	X	X	X				
6)	Whitefish Spawning							X	X			
7)	Acoustic Fish Census (Day)	X	X	X	X	X	X	X	X	X	X	X
	(Night)	X	X	X		X						
8)	Winter Fish Study								X	X	X	X
9)	Larids		XX									

the substrate between Douglas Point and McRae Point from a fixed height of 84 cm above the substrate (Figure 1.2-1). Duplicate substrate slides were taken at the splash zone and 3, 7 and 12 m depths along each of the nine survey transects. Duplicate slides were also taken 10 m on either side of each of the transect locations and midway between each transect at the splash zone.

Substrate particle sizes were determined from a 20% projected area of location substrate slides from each area photographed. A mean substrate particle size value was then calculated for each transect location and the corresponding 10 m location on either side of the transect location.

2.1.2 Sedimentation

Sediment traps were set at 3, 7 and 12 m depth contours along each of the nine transects shown in Figure 1.2-1. Each trap consisted of four PVC tubes, 63 cm high with an inside diameter of 5 cm, vertically supported on metal stands. The lower end of each tube was sealed. SCUBA divers capped, retrieved and reset the tubes in July and late September with final recovery in mid and late November. Upon recovery, the contents of each tube were preserved in 10% formalin.

The contents of each tube were allowed to settle for one hour, oven dried at 105°C to a constant weight and then ashed at 525°C for 2 hours. Results were expressed in $gm/cm^2/day$.

2.1.3 Temperature

Lake water temperatures were continuously monitored during the survey period by Hydraulic Studies and Development Department at THB04, 1 km offshore of the Bruce GS 'B' intake at 18 m depth and at THB08, 0.2 km offshore of the Bruce GS 'B' plant at 2.0 m depth (Figure 1.2-1).

2.2 Chemical Characteristics

2.2.1 Water Chemistry

Water quality samples were collected monthly from May to October at Bruce 'B' intake 12 m surface, Bruce 'B' intake 12 m bottom, Bruce 'B' discharge 3 m surface and Bruce 'B' discharge 7 m surface (Figure 1.2-1). The water quality samples were collected in a PVC Van Dorn sampler and preserved and stored according to the guidelines in Ontario Hydro Research Division Report No 78-285-K.

Analytical Services Section of the Chemical Research Department analyzed the water samples for the parameters listed in Table 2.2-1.

TABLE 2.2-1

Water Quality Analyses Parameters
Bruce GS 'B' - 1980

pH	
Colour	Suspended Solids at 105°C (mg/L)
Specific Conductance (mS/m)	Suspended Solids at 550°C (mg/L)
Turbidity (NTU)	Dissolved Solids at 105°C (mg/L)
Colour	Dissolved Solids at 550°C (mg/L)
Chemical Oxygen Demand [mg/L as COD]	Biological Oxygen Demand (mg/L)

2.3 Biological Characteristics

2.3.1 Ichthyoplankton

Larval fish were collected during the day at three nearshore areas in each of Holmes Bay and Inverhuron Bay weekly from mid May to the end of July (Figure 1.2-1). The surface five-minute tows were run parallel to shore at each site using two 0.5 m diameter conical nets with a 363 µm mesh size. All of the samples were preserved in 10% formalin. Samples were sorted and all larval fish identified to species when possible. The total length and weight for each species were determined up to a maximum of ten randomly selected fish for each species per sample.

2.3.2 Adult and Juvenile Fish

Gill nets, trap nets and beach seines were utilized to sample the juvenile and adult fish communities in the vicinity of Bruce GS 'B' (Figure 1.2-1). All fish captured were identified, counted and examined externally for disease, lamprey scars, spawning condition and tags. All salmonids and 100 whitefish were weighed, measured (fork length) and aged.

All gill nets were set perpendicular to shore monthly from May to November to sample the benthic-pelagic fish communities. Two consecutive 24-hour experimental gill net sets were made at the 3 and 12 m depth along the six transects listed in Table 2.3.2-1.

Two 1.2 m (4.0 ft) trap nets were set for two consecutive 24-hour periods coincident with the gill net sampling to sample the inshore benthic fish community. The trap nets were fished monthly from May to October at the locations listed in Table 2.3.2-1.

Beach seines (15.2 m, 0.64 cm - all mesh) were used to sample the nearshore fish community. Three-quarter circle sweeps, covering approximately 100 m^3 per sweep were made monthly from May to October coincident with the gill netting. All seines were conducted after dusk. Either all of the fish captured or a random sample and selected sample combination were preserved in 10% formalin.

TABLE 2.3.2-1

Monthly Fish Sampling Locations
Bruce GS 'B' - 1980

Location	Sampling Gear		
	Trap Nets	Gill Nets	Beach Seines
Douglas Point	2.5 m	3, 12 m	X
Bruce 'B' Discharge	2.5 m	3, 12 m	
Bruce 'B' Intake		3, 12 m	X
Holmes Bay	2.5 m	3, 12 m	X
Gunn Point	3.0 m	3, 12 m	X
McRae Point	3.0 m	3, 12 m	X

2.3.3 Acoustic Fish Census

An acoustic fish census was conducted in 1980 using a high-resolution echo sounder interfaced with automatic echo sorting and data logging equipment. The equipment and procedures for conducting the surveys were the same as those described for 1979 (Ontario Hydro Research Division Report NoC82-229-K).

The acoustic fish census grid was altered in 1980 to improve resolution of alongshore differences. It consisted of 13 parallel transects, approximately perpendicular to shore, from Gunn Point in the south to Douglas Point GS in the north (Figure 1.2-2). The outer margins of the transects were marked by spars location set by radar-triangulation (Hydraulic Studies and Development Department). The lengths of transects shown are approximate pending processing of the acoustic survey data.

The procedure for gill netting was amended in 1980 by setting nets at three locations of observed echo concentration, rather than setting nets inshore (surface and bottom) and offshore (bottom) along the middle transect.

The scheduled sampling program consisted of monthly day samples from May to March, while night samples were taken in May, June, July and September only. Detrimental weather conditions prevented sampling December through March.

2.3.4 Whitefish Spawning Study

In order to document any whitefish spawning activity in the Bruce GS 'B' vicinity, experimental gill nets (Section 2.3.2) were set for two consecutive 24-hour periods at the locations listed in Table 2.3.2-1. The gill nets were set perpendicular to shore commencing at the 3 and 12 m depths in mid November and early December. All whitefish collected were examined for spawning condition and injury. The weights, fork lengths and ages were determined for one hundred whitefish.

2.3.5 Winter Fish Study

A winter (December-March) adult and juvenile fish sampling program was conducted (weather conditions permitting) to provide information on the benthic-pelagic winter fish communities at the Bruce GS 'B' site. Experimental gill nets (Section 2.3.2) were scheduled to be set perpendicular to shore monthly at the 3 and 12 m depths along the transects listed in Table 2.3.2-1. All catches were speciated, counted and examined externally for injury, spawning condition and tags. All salmonids and one hundred whitefish were to be aged, weighed and measured (fork length).

2.3.6 Nesting Larid Study

The land fill and armour stone areas on the Bruce GS 'B' construction site were visually surveyed for nesting larids by a two person crew during May. The number and location of each nest were recorded.

3.0 RESULTS

3.1 Physical Characteristics

3.1.1 Substrate

Substrate is an important physical parameter in determining the macroinvertebrate and attached algae distributions, and the location of fish spawning areas.

Substrate surveys in 1979 indicated a very heterogeneous substrate in the Bruce GS 'B' vicinity (Ontario Hydro Research Division Report No C82-229-K). The 1980 substrate survey results revealed the same heterogeneous substrate characteristic (Appendix A). The substrate slides midway between each transect, planned to aid in defining the heterogeneous substrate, were not taken due to weather conditions. Substrate analysis at the spar locations however, indicated a predominance of bedrock (38%) with cobble (25%), boulder (17%) and pebble (14%). Sand (4%) and gravel (2%) were present only in minimum quantities.

Bedrock was the dominant substrate type determined along the 3 and 7 m depth contours with composition percentages of 51 and 42% respectively (Figure 3.1.1-1). Cobble and boulder comprised 19 and 16% at 3 m locations respectively, and 24 and 19% at 7 m. Sand and silt were absent at both 3 and 7 m depth sampling locations. Cobble was predominant at 12 m forming 32% of

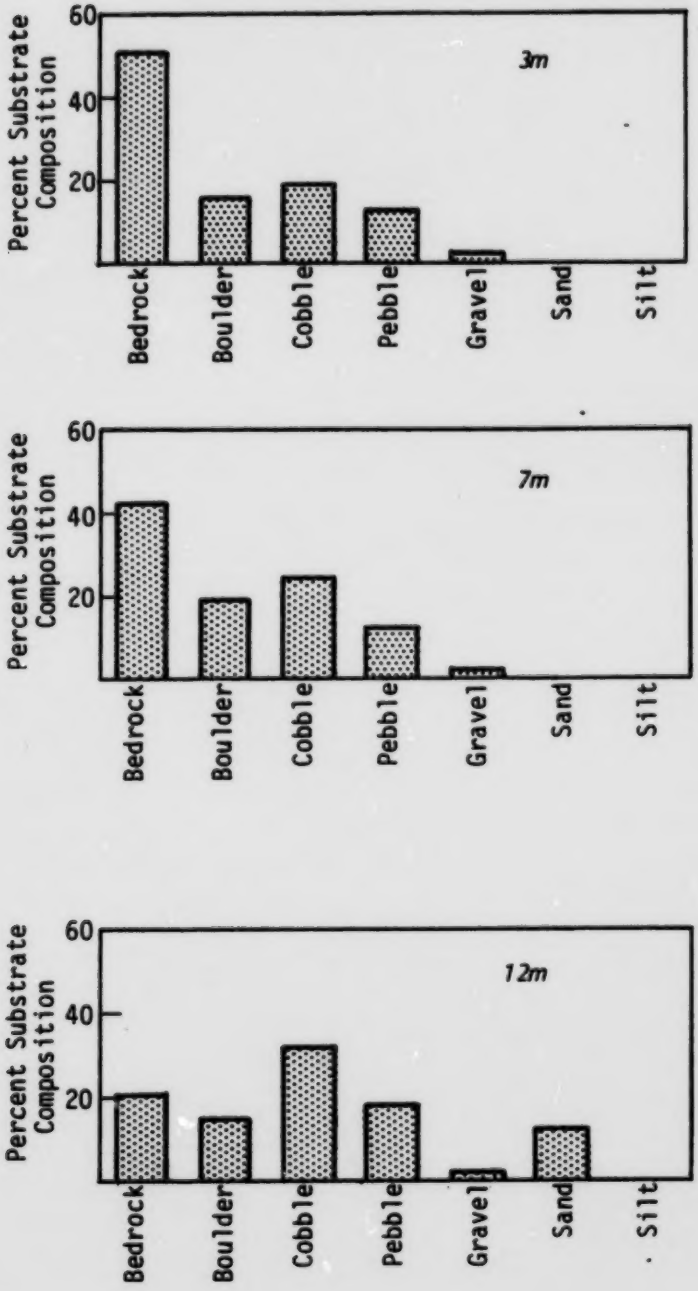


FIGURE 3.1.1-1

PERCENT SUBSTRATE COMPOSITION ALONG 3, 7 AND 12m DEPTH CONTOURS

BRUCE GS 'B' 1980

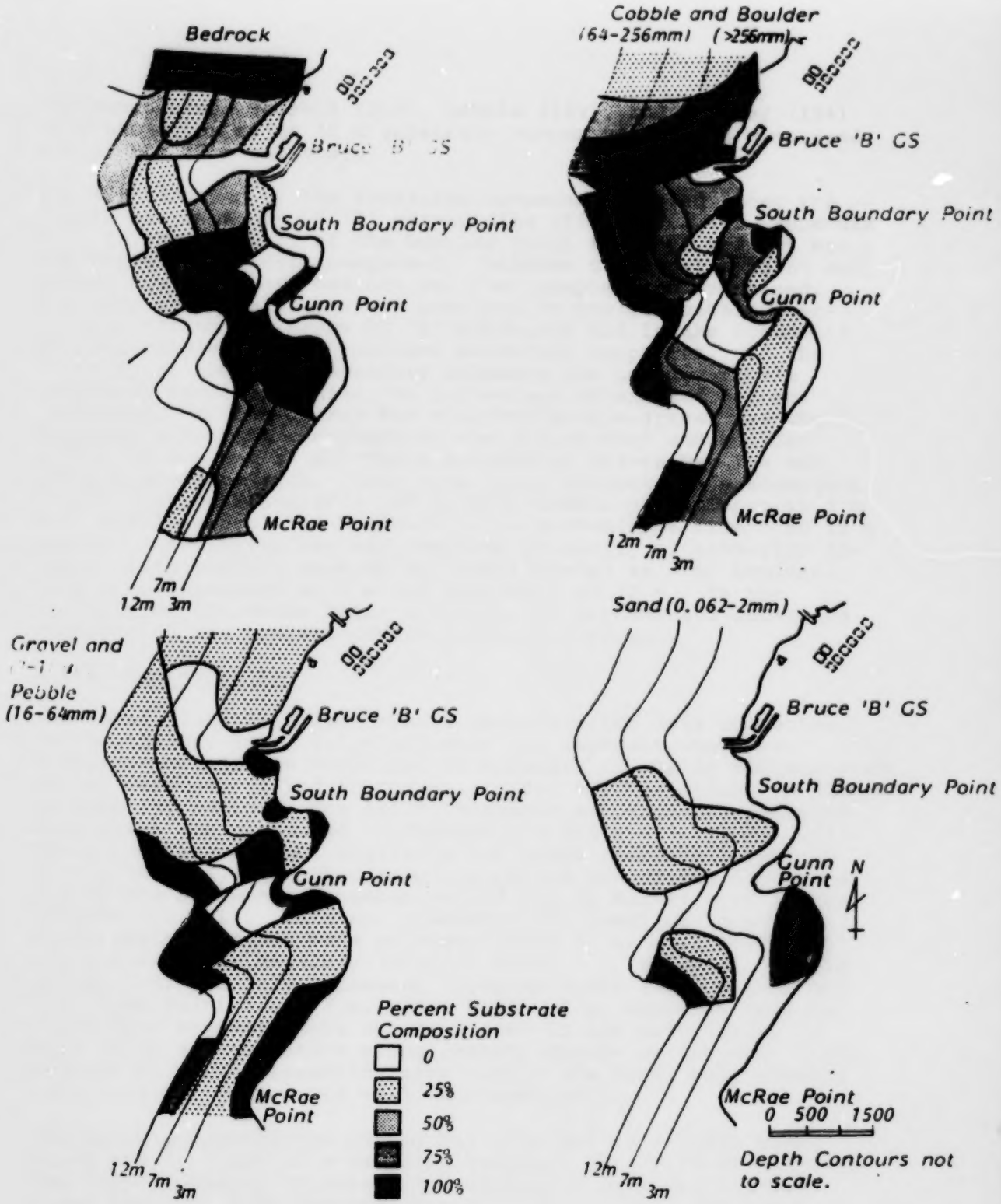


FIGURE 3.1.1-2

PERCENT SUBSTRATE COMPOSITION
BRUCE 'B' GS 1980

82-205

the substrate. Bedrock (21%), pebble (18%), and boulder (15%) were the other major 12 m substrate components. Sand comprised 12% of the 12 m substrate.

The distribution of the substrate components varied along the length of the Bruce GS 'B' survey site (Figure 3.1.1-2, Appendix B). In the vicinity of the Douglas Point transect bedrock was the primary substrate component. Between the Douglas Point and Lagoon Bay transects bedrock per cent composition decreased. The bedrock in this area was overlain by boulder-cobble overburden. Along the Bruce GS 'B' discharge and intake transects boulder-cobble was the dominant substrate component. In the vicinity of the South Boundary transect the boulder-cobble component decreased while the percentage of exposed bedrock increased. Within Holmes Bay vicinity pebble-gravel was the dominant substrate component at the splash zone and boulder-cobble at 3 m and 12 m. The substrate at Holmes Bay 7 m was predominantly bedrock. Near Gunn Point bedrock was predominant at 3 m with pebble-gravel and boulder-cobble predominant at 1 m and pebble-gravel and boulder-cobble predominant from 7 to 12 m depths. Inverhuron Bay was composed primarily of sand-silt inshore, with bedrock covered by pebble-gravel at 3 m, boulder-cobble over bedrock at 7 m and sand-silt at 12 m. In the vicinity of the McRae Point transect the predominant substrate composition was boulder-cobble overlying bedrock.

3.1.2 Sedimentation

The total, inorganic and organic sedimentation data collected during the May-July, July-September and September-November sampling periods are contained in Appendix C. Daily sedimentation values were calculated to compensate for the variations in length of sampling period. The daily inorganic and organic sedimentation rates are presented in Figures 3.1.2-1 and 3.1.2-2. Sedimentation data are not available for eight sampling locations during the July-September sampling period and eleven locations during the September-November period due to marker spar losses (Figure 3.1.2-1). Data are presented for sampling locations where sediment tubes were on their sides or at more than a 45° angle during the May-July (Douglas Point 7 m, Bruce GS 'B' Discharge 7 m) and July-September (Douglas Point 12 m, Lagoon Bay 7 m, Gunn Point 3 and 7 m, McRae Point 12 m) sampling periods. These data however, have not been used in the calculation of mean daily sedimentation along contour depths or transect lines. Because of these discontinuities within the data, only general sedimentation statements will be presented.

Inorganic sedimentation during May-July was relatively equal along the 3, 7 and 12 m sampling contours ($\bar{x}$ = 0.01 gm/cm^2/day). The July-September inorganic sedimentation rate was highest along the 7 m depth contour ($\bar{x}$ = 0.23 gm/cm^2/day) and least along the 3 m depth contour ($\bar{x}$ = 0.04 gm/cm^2/day). A relatively equal rate of sedimentation was present along the 7 and 12 m depth contours ($\bar{x}$ = 0.05 gm/cm^2/day) while a lower rate was determined along the 3 m depth contour ($\bar{x}$ = 0.02 gm/cm^2/day) during September-November sampling.

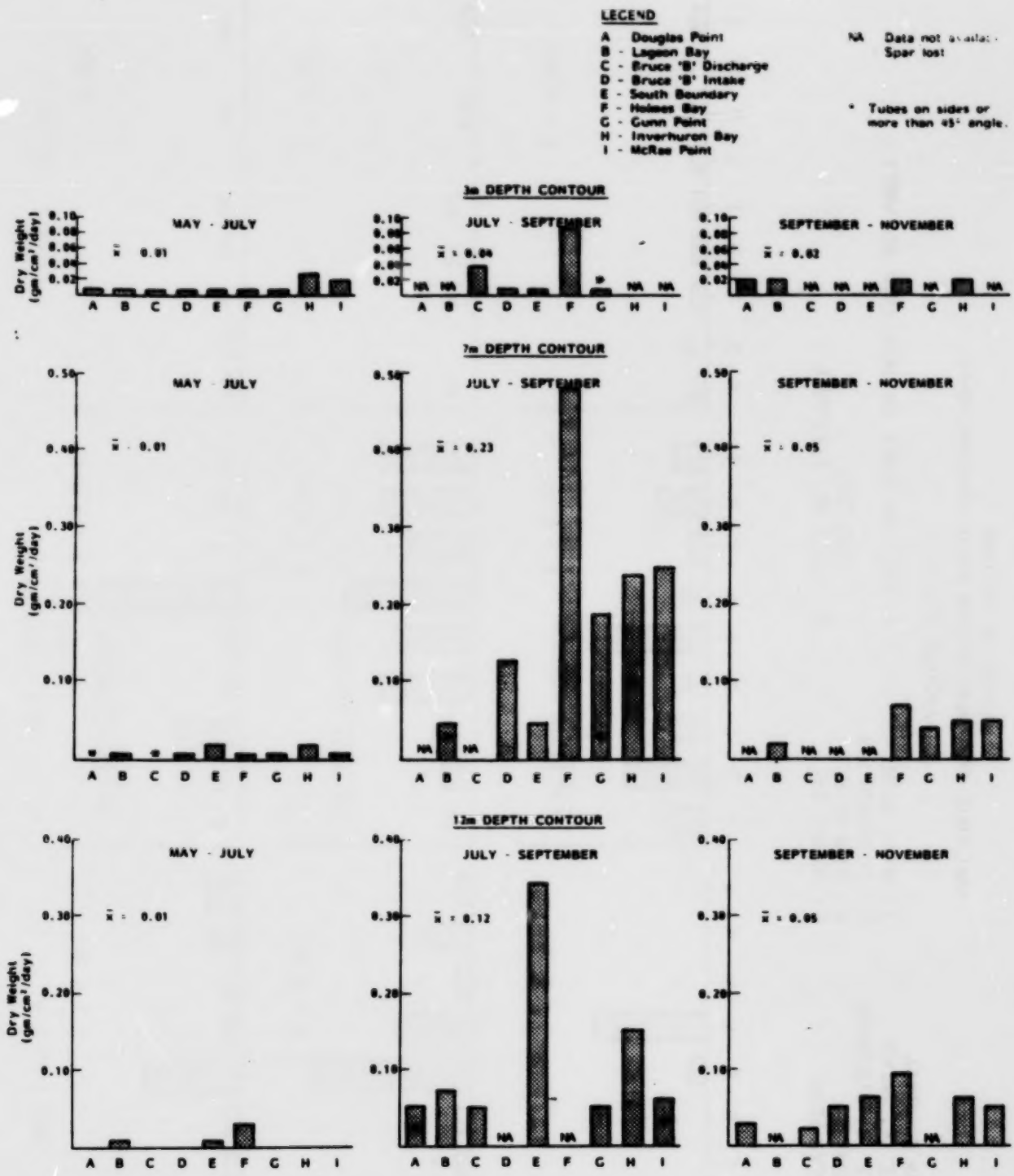
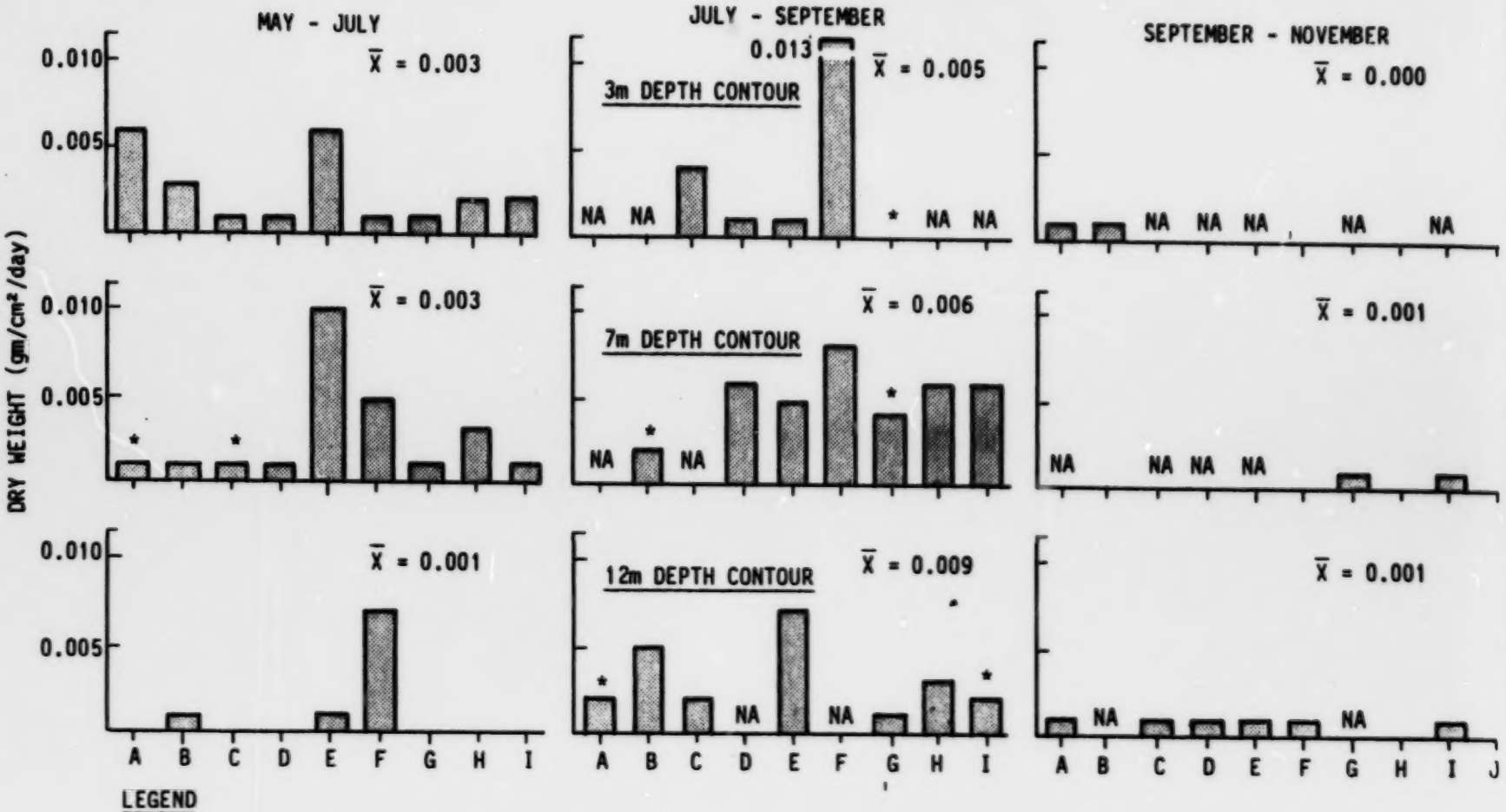

LEGEND
A Douglas Point
B - Lagoon Bay
C - Bruce 'B' Discharge
D - Bruce 'B' Intake
E - South Boundary
F - Holmes Bay
G - Gunn Point
H - Inverhuron Bay
I - McRae Point
NA Data not available Spar lost
* Tubes on sides or more than 45° angle.
3m DEPTH CONTOUR
7m DEPTH CONTOUR
12m DEPTH CONTOUR
MAY - JULY
JULY - SEPTEMBER
SEPTEMBER - NOVEMBER
Dry Weight (gm/cm²/day)
A B C D E F G H I

FIGURE 3.1.2-1
INORGANIC SEDIMENTATION RATE (gm/cm²/day)
BRUCE 'B' GS 1980



LEGEND

A - DOUGLAS POINT
B - LAGOON BAY
C - BRUCE 'B' DISCHARGE
D - BRUCE 'B' INTAKE
E - SOUTH BOUNDARY
F - HOLMES BAY
G - GUNN POINT
H - IVERHURON BAY
I - McRAE POINT

NA - DATA NOT AVAILABLE
- SPAR LOST

* TUBES ON SIDES OR MORE THAN 45° ANGLE

FIGURE 3.1.2-2
ORGANIC SEDIMENTATION RATE (gm/cm²/day)
BRUCE 'B' GS 1980

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157496 RD

The May-July organic sedimentation rate was relatively equal along the 3 and 7 m depth contours ($\bar{x}$ = 0.003 gm/cm^2/day) but decreased to a mean rate of 0.001 gm/cm /day along the 12 m depth contour. The greatest July-September organic sedimentation rate was determined along the 7 m depth contour ($\bar{x}$ = 0.006 gm/cm^2/day) with the least again along the 12 m depth contour ($\bar{x}$ = 0.004 gm/cm^2/day). The available September-November organic sedimentation data indicated a relatively equal rate of sedimentation along the 7 and 12 m depth contours ($\bar{x}$ = 0.001 gm/cm^2/day).

Analysis of the inorganic sedimentation rates along transects indicated high May-July sedimentation along the South Boundary, Holmes Bay and Inverhuron Bay transects ($\bar{x}$ = 0.02 gm/cm^2/day). Along the remaining May-July sampling transects the rate was relatively uniform ($\bar{x}$ = 0.01 gm/cm^2/day). Holmes Bay ($\bar{x}$ = 0.29 gm/cm^2/day), McRae Point ($\bar{x}$ = 0.25 gm/cm^2/day) and Inverhuron Bay ($\bar{x}$ = 0.20 gm/cm^2/day) transects had the highest July-September sedimentation rates while Douglas Point, Bruce 'B' discharge and Gunn Point transects had the lowest sedimentation rates ($\bar{x}$ = 0.03 gm/cm^2/day). During the September-November sampling period the greatest inorganic sedimentation rates were determined at South Boundary and Holmes Bay transects ($\bar{x}$ = 0.06 gm/cm^2/day) and the least along the Lagoon Bay and Bruce 'B' discharge transects ($\bar{x}$ = 0.02 gm/cm^2/day).

Organic sedimentation was greatest along the South Boundary ($\bar{x}$ = 0.006 gm/cm^2/day), Holmes Bay ($\bar{x}$ = 0.004 gm/cm^2/day) and Douglas Point ($\bar{x}$ = 0.003 gm/cm^2/day) transects during the May-July sampling period. Organic sedimentation was relatively low along the remaining six sampling transects ($\bar{x}$ = 0.001 gm/cm^2/day). The July-September organic sedimentation rate was highest along the Holmes Bay transect ($\bar{x}$ = 0.011 gm/cm^2/day). Along the remaining eight transects, the July-September organic sedimentation rate ranged from 0.001 gm/cm^2/day along the Gunn Point transect to 0.006 gm/cm^2/day along the McRae Point transect. The organic sedimentation rate decreased along transects in the September-November sampling period with mean values of 0.001 gm/cm^2/day or less along all transects.

Extremely high per cent organic content values were determined at Douglas Point 3 m (39.5%) and South Boundary 7 m (32.9%) during the May-July sampling period (Table 3.1.2-1). High values were recorded at South Boundary 3 m (29.2%) and Holmes Bay 7 m (24.8%) in the same sampling period. The per cent organic content was lower in the July-September and September-November sampling periods when high values of 13.3% (South Boundary 3 m) and 3.3% (Bruce 'B' discharge 12 m) were determined respectively.

3.1.3 Temperature

Mean daily water temperatures recorded inshore at 2.0 M (THB08) and offshore at 18.0 M (THB04) are presented in Figure 3.1.3-1, Appendix D. Recorded inshore water temperatures were generally greater and temporally stabler than offshore temperatures. Mean inshore summer (June-August) and fall (September-November) water temperatures were 15.1 and 12.3°C respectively, while offshore summer and fall mean water temperatures were 9.1 and 10.9°C.

TABLE 3.1.2-1

PERCENT ORGANIC CONTENT
BRUCE 'B' GS - 1980

MAY-JULY

Depth Contour (m)	Douglas Point	Lagoon Bay	Bruce 'B' Discharge	Bruce 'B' Intake	South Boundary Point	Holmes Bay	Gunn Point	Inverhuron Bay	McRae Point
3	39.5	25.2	11.3	10.3	29.2	7.9	9.5	6.0	10.4
7	*12.2	11.6	*10.9	11.1	32.9	24.8	7.5	11.9	9.5
12	9.1	8.9	10.3	12.1	4.4	18.5	10.7	6.5	8.3

JULY-SEPTEMBER

3	-	-	9.9	7.0	13.3	12.7	*3.3	-	-
7	-	*3.9	-	4.3	8.7	1.6	*2.0	2.3	2.4
12	*5.3	6.6	8.3	-	2.0	-	4.2	2.1	*4.1

SEPTEMBER-NOVEMBER

3	3.2	2.4	-	-	-	1.8	-	1.3	-
7	-	1.3	-	-	-	0.6	2.3	0.9	1.0
12	2.4	-	3.3	1.7	0.8	0.8	-	0.6	1.7

(*Questionable values; tubes on sides or more than 45° angle.)

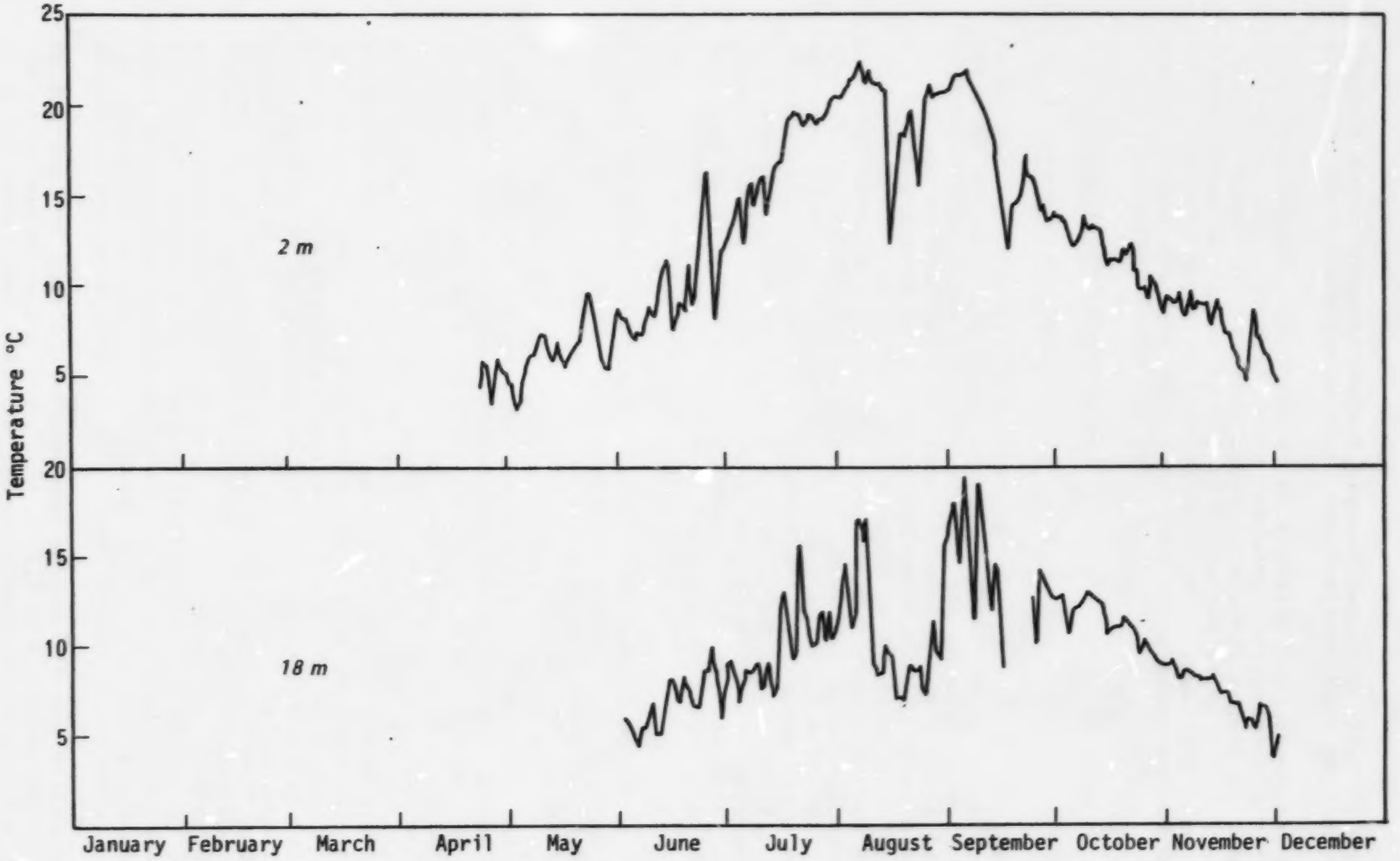

FIGURE 3.1.3-1

MEAN DAILY WATER TEMPERATURE NEAR BRUCE 'B' DISCHARGE
2m (THB-08) AND 18m (THB-04) BRUCE 'B' GS 1980

82-205
156586 RD

Inshore water temperature was highest August 8 (22.3°C) while offshore the bottom temperature was greatest September 5 (19.6°C).

Cold water upwellings occurred erratically throughout the monitoring periods, occurring more frequently offshore. A major offshore upwelling existed August 10 through August 29 with water temperatures declining from 17.3°C (August 8) to 6.9°C (August 16). Inshore, short periods of cold water upwelling were recorded during the same time span with water temperatures decreasing 8.3°C between August 14 and 15.

3.2 Chemical Characteristics

3.2.1 Water Chemistry

Water quality data are presented in Table 3.2.1-1. The lake water pH was slightly basic on all sampling dates. Little seasonal differences were detected in the pH with lowest pH of 8.1 observed at all locations in October and highest pH of 8.4 prevalent from July through September. A pH range of 8.1 (Douglas Point 7 m, June) to 8.5 (Gunn Point, 7 m, October) was recorded in 1978 (Ontario Hydro Research Division Report 80-43-K). Specific conductance, a measure of the total amount of ionized material in water, ranged between 18.5 and 24.4 mS/m (millisiemens/meter). Seasonally, lowest specific conductance was measured on September 25 at all four locations. Specific conductance was higher at the 3 m Bruce 'B' discharge spar on all sampling dates except May 23. Nearshore surficial water specific conductance values recorded near Port Elgin in 1975 ranged from 20.7 to 23.3 mS/m (Ross and Chatterjee, 1977).

Rivers and lakes in Ontario, free of industrial waste, normally have a dissolved solids concentration equal to 0.65 ±0.10 times the specific conductance of the water in micromhos/cm (MOE, 1975). (1 micromhos/cm = 0.1 mS/m) The concentration of dissolved solids on the six sampling dates ranged from 113 to 147 mg/L. These concentrations were between 0.55 and 0.68 times the conductivity levels. Lowest dissolved solids concentrations were found on June 18 at all locations except the 3 m Bruce 'B' discharge spar where a seasonal high level was found. On this day the dissolved solids concentrations were 113, 115, 114 and 147 mg/L at the Bruce 'B' intake 12 m surface, and bottom, the Bruce 'B' discharge 7 m spar and the Bruce 'B' discharge 3 m spar respectively. Dissolved solids levels in lakes occupying open basins are generally between 100 and 200 mg/L (Reid, 1961). Largest difference between surface and bottom dissolved solids concentrations at the Bruce 'B' intake 12 m location was found on August 13 when surface concentrations were 132 mg/L and bottom concentrations were 123 mg/L. The organic content of the dissolved solids was high and ranged from 28 to 15%. Detectable suspended solids levels ranged from 0.4 to 2.6 mg/L. No seasonal or spatial trends were obvious in the concentrations of the suspended solids. The organic content of the suspended solids varied considerably and ranged from <25 to 100%.

No seasonal or spatial pattern was obvious in the turbidity of the water which ranged from 0.34 to 1.5 NTU. Apparent colour, which is associated with the presence of humic acid, was not detected in any of the samples.

TABLE 3.2.1-1

WATER QUALITY PARAMETERS, BRUCE GS 'B', LAKE HURON - MAY-OCTOBER, 1980

	May 23				June 18				July 28				August 13				September 25				October 23			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
pH	8.1	8.1	8.1	8.1	8.3	8.3	8.3	8.3	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.2	8.3	8.4	8.4	8.1	8.1	8.1	8.1
Specific Conductance (mS/m)	21.3	19.6	20.9	20.3	20.1	20.9	24.4	20.0	21.0	20.4	22.1	20.9	20.8	20.5	21.1	21.1	18.9	19.2	19.3	18.5	19.6	19.6	21.4	19.5
Turbidity (NTU)	0.71	0.60	0.48	0.36	0.53	0.74	0.90	0.52	0.47	0.53	0.98	0.64	0.68	1.5	0.64	0.76	0.34	0.78	0.59	0.59	0.60	0.77	0.88	0.42
Colour	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
Suspended Solids (mg/L)																								
105°C	0.4	1.0	0.6	1.0	1.0	0.8	1.2	0.6	1.0	1.0	2.6	0.8	1	2	2	1	<1	<1	<1	<1	<1	1	1	1
550°C	<0.1	0.4	0.2	0.6	1.0	0.8	1.2	0.2	0.4	0.4	1.4	0.2	<1	<1	1	<1	<1	<1	<1	<1	<1	1	1	<1
Dissolved Solids (mg/L)																								
105°C	124	122	137	118	113	115	147	114	121	120	128	136	132	123	129	138	125	120	132	123	115	118	128	115
550°C	101	97	110	98	86	87	117	90	98	99	109	98	102	97	101	107	98	96	102	91	95	99	105	95
COD (mg/L as COD)	<2	<2	16	18	5	4	3	<2	14	21	17	10	<2	<2	7.9	4	13	6	3	12	5	5	6	6
BOD (mg/L)	1	1	1	2	<1	1	1	<1	<1	1	<1	<1	<1	<1	<1	<1	1	1	<1	<1	1	1	<1	<1

A = Bruce 'B' Intake, 12 m Surface
B = Bruce 'B' Intake, 12 m Bottom
C = Bruce 'B' Discharge, 3 m Surface
D = Bruce 'B' Discharge, 7 m Surface

The chemical oxygen demand (COD) ranged from <2 to 21 mg/L and was highest on July 28 at all locations except the Bruce 'B' discharge 7 m location. The biological oxygen demand (BOD) was highest on May 23 at all four locations, when the demand was between 2 and 3 mg/L. With the exception of the Bruce 'B' intake 12 m surface sample collected on September 25, the BOD was below or at the detection level of 1 mg/L on the remaining sampling dates.

3.3 Biological Characteristics

3.3.1 Ichthyoplankton

The species composition of larval fish collected at Holmes Bay and Inverhuron Bay between May 23 and July 29 is presented in Table 3.3.1-1. The main species collected in both bays was rainbow smelt which made up 77% of the larval fish collected in Holmes Bay and 67% of the larval fish in Inverhuron Bay. Alewife was the second most abundant species and made up 14 and 25% of the larval fish taken in Holmes Bay and Inverhuron Bay, respectively. Burbot, unidentified cyprinids, spottail shiner and carp larvae were also collected in both bays and yellow perch and freshwater drum larvae were taken in Holmes Bay only.

Maximum estimated densities (Figure 3.3.1-1, Table 3.3.1-2) of rainbow smelt larvae in both Holmes Bay and Inverhuron Bay were found on May 23 (1920 and 1660 per 1000 m^3, respectively) and maximum densities of alewife occurred in late July (1353 and 695 per 1000 m^3, respectively).

The mean length (±1 standard deviation) of the rainbow smelt and alewife collected in Holmes Bay and Inverhuron Bay on the various sampling dates are shown in Figure 3.3.1-2.

The mean length of the smelt larvae on the first day of sampling, May 23, was 5.1 mm in Holmes Bay and 5.3 mm in Inverhuron Bay. Smelt larvae are about 5 mm when hatched (Scott and Crossman 1973). The smelt larvae caught in Holmes Bay on July 9, the last date on which a smelt larvae was captured, was 6.5 mm. Smelt larvae had dispersed from Inverhuron Bay by mid-June and from Holmes Bay by mid-July.

The equation derived relating larval smelt weight to total length was:

$$\log_{10} wt = 2.6017 \log_{10} (T.L.) - 6.4089$$

A plot relating larval smelt weight ($\log_{10}$) to their total length ($\log_{10}$) is shown in Figure 3.3.1-3a. The correlation coefficient, however, was relatively low (0.68).

The mean length of alewife larvae on July 16 was 4.4 and 4.5 mm in Holmes Bay and Inverhuron Bay respectively. In Holmes Bay the mean length of larval alewife increased to 7.2 mm on July 24 and was only 3.2 mm on July 29 indicating a second spawn had occurred. In Inverhuron Bay mean length did not vary greatly on the three sampling occasions when alewife larvae were caught (4.3 - 4.5 mm). However, the range in length of individual larvae indicated that larger larvae were still present in the bay.

TABLE 3.3.1-1

Species Composition of Larval Fish Collected at Holmes Bay and Inverhuron Bay - Bruce GS 'B' Preoperational Study - Year II, 1980 Lake Huron

	Holmes Bay		Inverhuron Bay	
	Total No Caught	%	Total No Caught	%
Rainbow Smelt	431	77.2	307	67.2
Alewife	79	14.2	112	24.5
Burbot	35	6.3	32	7.0
Cyprinids	8	1.4	2	0.4
Spottail Shiner	1	0.2	2	0.4
Yellow Perch	2	0.4	0	0.0
Freshwater Drum	1	0.2	0	0.0
TOTAL	558		457	

TABLE 3.3.1-2

Larval Fish Densities Between May 23 and July 29, 1980
in Holmes Bay and Inverhuron Bay
- Bruce GS 'B' Preoperational Study - Year II
Lake Huron

No/1000 m^3

Species	May 23	May 29	June 3	June 11	July 9	July 16	July 24	July 29
Holmes Bay								
Rainbow Smelt	1920	360	20	3	5	-	-	-
Burbot	-	160	110	-	5	-	-	-
Yellow Perch	-	-	-	-	10	-	-	-
Alewife	-	-	-	-	-	90	1353	1420
Spottail Shiner	-	-	-	-	-	3	-	-
Carp	-	-	-	-	-	5	-	-
Cyprinids	-	-	-	-	-	-	1283	20
Freshwater Drum	-	-	-	-	-	-	7	-
Inverhuron Bay								
Rainbow Smelt	1660	230	10	-	-	-	-	-
Burbot	40	180	346	-	-	-	-	-
Yellow Perch	-	-	-	-	-	-	-	-
Alewife	-	-	-	-	-	-	-	232
Spottail Shiner	-	-	-	-	-	120	695	-
Carp	-	-	-	-	-	-	-	5
Cyprinids	-	-	-	-	-	5	-	5
						5		

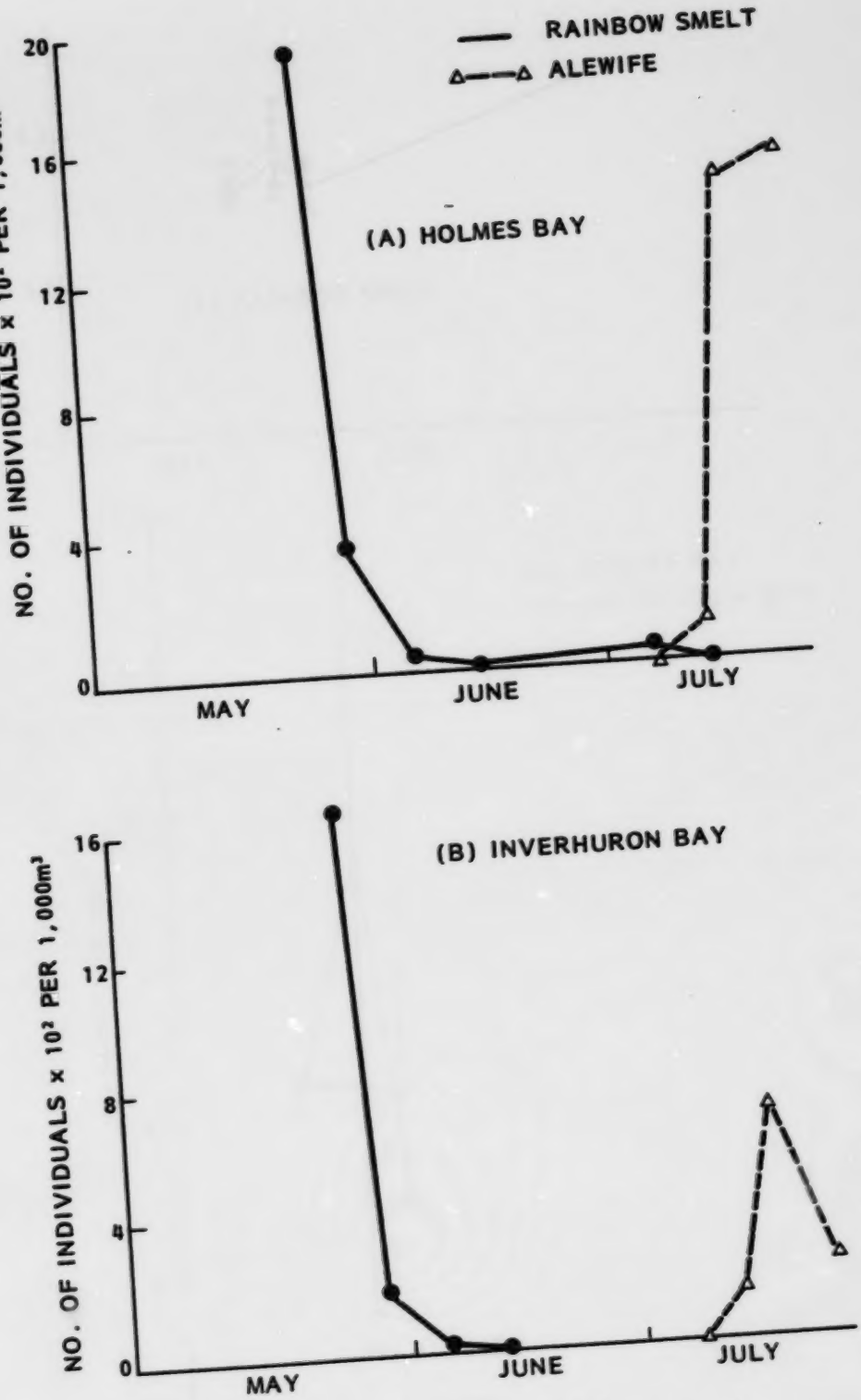

FIGURE 3.3.1-1

SEASONAL DENSITIES NO. x 10^2 PER 1,000 m^3 OF LARVAL (A) RAINBOW SMELT AND (B) ALEWIFE DURING BRUCE GS 'B' PREOPERATIONAL SURVEY - YEAR II, 1980 - LAKE HURON

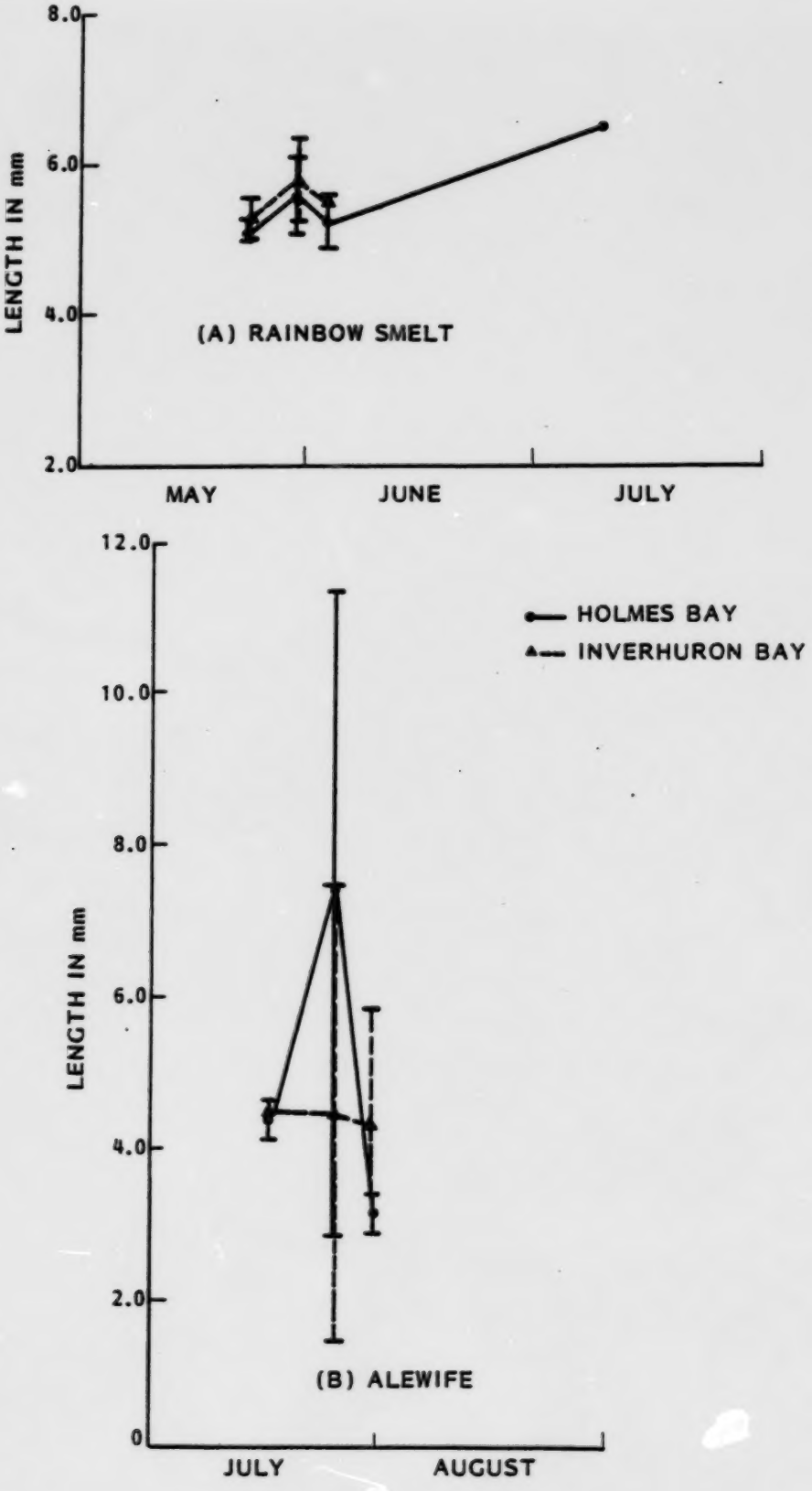

FIGURE 3.3.1-2

MEAN LENGTH ± 1 STANDARD DEVIATION OF (A) LARVAL SMELT AND (B) LARVAL ALEWIFE COLLECTED IN HOLMES BAY (—●—) AND INVERHURON BAY (--▲--) BRUCE GS 'B' PREOPERATIONAL STUDY YEAR II - 1980

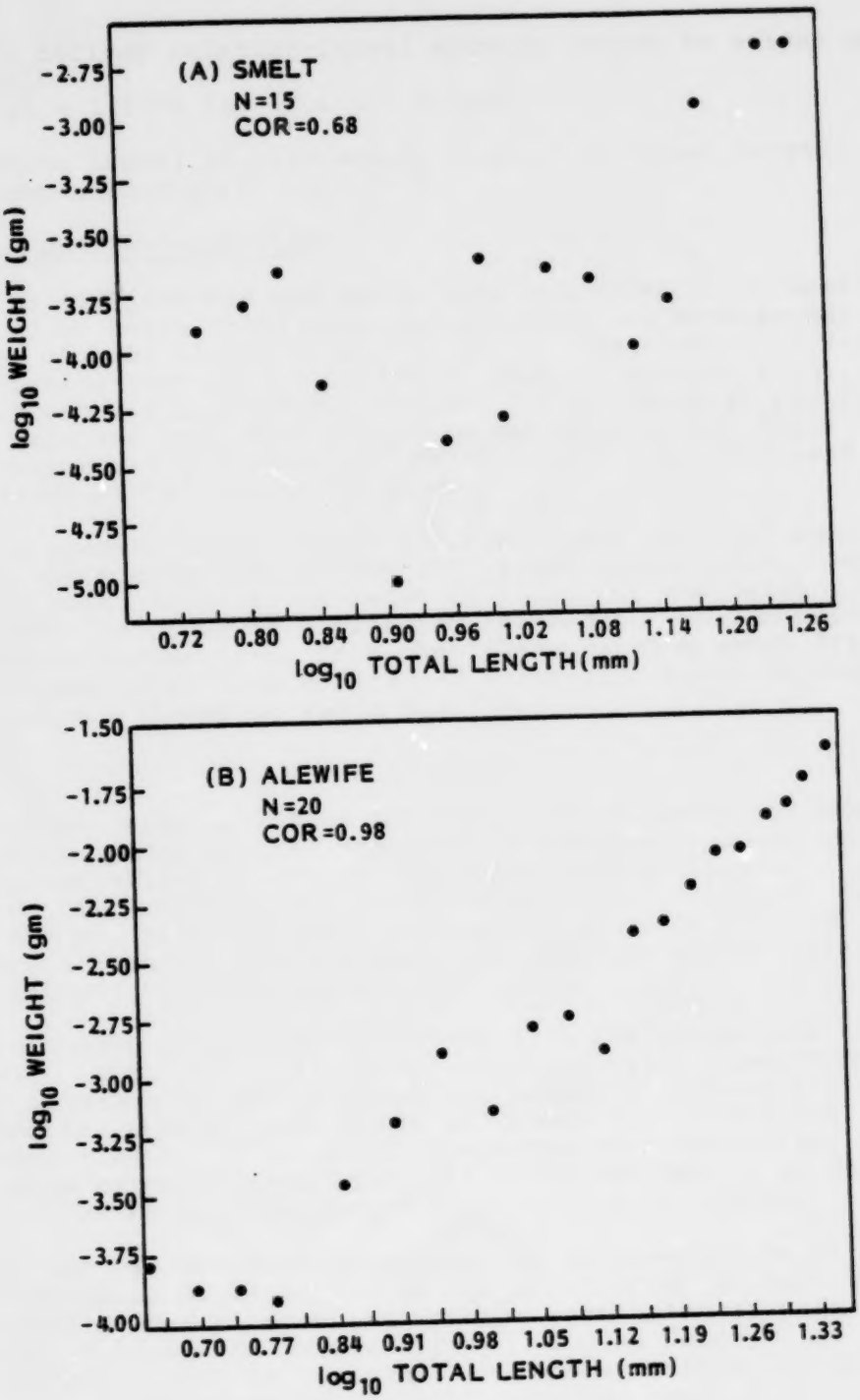

FIGURE 3.3.1-3

WEIGHT AND TOTAL LENGTH RELATIONSHIP OF (A) LARVAL RAINBOW SMELT AND (B) LARVAL ALEWIFE. BRUCE G.S. 'B' PREOPERATIONAL STUDY YEAR II, 1980

The equation derived relating larval alewife length to weight was:

$$\log_{10} wt = 3.4668 \log (T.L.) - 6.4007$$

A plot relating larval alewife weight ($\log_{10}$) to total length ($\log_{10}$) is shown in Figure 3.3.1-3b.

3.3.2 Adult and Juvenile Fish

A total of 23 558 juvenile and adult fish belonging to 41 species was collected by beach seine, trap net and gill net between May and November of 1980 in the Bruce 'B' study area (Table 3.3.2-1). All three fishing gear were utilized at each of Douglas Point, Holmes Bay, Gunn Point and McRae Point. Due to physical restrictions gill nets and trap nets only were employed at the Bruce GS 'B' discharge and gill nets and beach seines only were used along the Bruce GS 'B' intake transect.

The two main species taken during the study were spottail shiner and alewife which comprised 28 and 26% of the total catch. Other species that contributed to at least 1% (>200) of the total catch included, in order of decreasing abundance: yellow perch (12%), longnose sucker (9%), lake chub (7%), rainbow smelt (7%) and white sucker (6%). The common and scientific names of the species found are listed in Table 3.3.2-2.

Beach Seine

Spottail shiners made up 76% of the 8062 fish collected by beach seines. Yellow perch was the second most abundant species taken by beach seines making up 15% of the catch. An additional 17 species were identified in the beach seine catch. Longnose dace, bluntnose minnow, slimy sculpin, mottled sculpin, nine-spine stickleback, log perch, mimic shiner and roseface shiner were taken exclusively by beach seine.

Largest total numbers of fish collected by beach seine were taken at Gunn Point (4880, Table 3.3.2-3). Substantially lower numbers were taken at McRae Point (220) and the Bruce 'B' intake (110) and intermediate numbers were taken at Holmes Bay (1586) and Douglas Point (1266). A total of 10 species were identified in the beach seine catch at Gunn Point, 11 at Holmes Bay, 9 at Douglas Point, 10 at McRae Point and 6 at the Bruce 'B' intake.

Spottail shiner was the main species taken by beach seine at all locations making up at least 65% of the total catch at each location. Largest number of spottail shiners were taken at Gunn Point (3684), followed by Holmes Bay and Douglas Point, 1345 and 819 respectively. Only 187 spottail shiners were taken at McRae Point and 100 at the Bruce 'B' intake. Largest numbers of alewife taken by beach seine were caught at Douglas Point (389), where they were the second most abundant species taken. Alewife were not part of the beach seine catch at the Bruce 'B' intake and were caught in low numbers ($\leq$10) at the remaining locations. Largest numbers of yellow perch caught by beach seine were taken at Gunn Point where they were the second most abundant species taken by beach seine. A total of 1148 yellow perch was taken at that location. Yellow perch was also absent from the beach seine catch at the Bruce 'B' intake and was caught in substantially lower numbers ($\leq$50) at the remaining locations.

TABLE 3.3.2-1

Numbers of Fish Collected and Species Composition of Fish Collected by Beach Seine, Trap Net and Gill Net in Lake Huron at Bruce GS 'B' - 1980

Species	Beach Seine No	Beach Seine %	Trap Net No	Trap Net %	Gill Net No	Gill Net %	Total No	Total %
Spottail Shiner	6135	76.1			443	3.0	6578	27.9
Alewife	407	5.0	85	10.2	5694	38.8	6186	26.3
Yellow Perch	1203	14.9	44	5.3	1521	10.4	2768	11.7
Longnose Sucker			448	53.8	1726	11.8	2174	9.3
Lake Chub	5	<0.1	31	3.7	1644	11.2	1680	7.1
Smelt	5	<0.1			1589	10.8	1594	6.7
White Sucker			182	21.8	1214	8.3	1396	5.9
Gizzard Shad	1	<0.1			196	1.3	197	0.8
Round Whitefish					195	1.3	195	0.8
Emerald Shiner	59	0.7			58	0.4	117	0.5
Cyprinids	104	1.3					104	0.4
Longnose Dace	99	1.2					99	0.4
Yellow Pickerel					77	0.5	77	0.3
Burbot			3	0.4	70	0.5	73	0.3
Trout Perch	1	<0.1			60	0.4	61	0.3
Channel Catfish					53	0.4	53	0.2
Redhorse, Golden			8	<0.1	37	0.3	45	0.2
Smallmouth Bass	5	<0.1	19	2.2	14	<0.1	38	0.2
Bluntnose Minnow	24	2.9					24	0.1
Carp	1	<0.1	1	0.1	16	0.1	18	<0.1
Creek Chub					16	0.1	16	<0.1
Freshwater Drum					10	<0.1	10	<0.1
Rainbow Trout					9	<0.1	9	<0.1
Rock Bass			5	0.6	1	<0.1	6	<0.1
Slimy Sculpin	5	<0.1					5	<0.1
Stonecat			3	0.4	3	<0.1	6	<0.1
Lake Trout					3	<0.1	3	<0.1
Redhorse Sucker			2	0.2	1	<0.1	3	<0.1
Cisco					3	0.1	3	0.1
Mottled Sculpin	3	<0.1					3	<0.1
Splake					2	<0.1	2	<0.1
Chinook Salmon					2	<0.1	2	<0.1
Brown Bullhead			1	<0.1	1	<0.1	3	<0.1
Coho Salmon					2	<0.1	2	<0.1
White Bass					2	<0.1	2	<0.1
Nine-spine Stickleback	2	<0.1					2	<0.1
Brown Trout					1	<0.1	1	<0.1
Black Crappie					1	<0.1	1	<0.1
Log Perch	1	<0.1					1	<0.1
Mimic Shiner	1	<0.1					1	<0.1
Rosyface Shiner	1	<0.1					1	<0.1
TOTAL	8062		832		14664		23558	
No of sp.	(19)		(13)		(32)		(41)	

TABLE 3.3.2-2

Common and Scientific Names of Fish Collected in the Bruce GS 'B' Study Area - Lake Huron

Common Name	Scientific Name
Spottail Shiner	*Notropis hudsonius*
Alewife	*Alosa pseudoharengus*
Yellow Perch	*Perca flavescens*
Longnose Sucker	*Catostomus catostomus*
Lake Chub	*Couesius plumbeus*
Rainbow Smelt	*Osmerus mordax*
White Sucker	*Catostomus commersoni*
Gizzard Shad	*Dorosoma cepedianum*
Round Whitefish	*Prosopium cylindraceum*
Emerald Shiner	*Notropis atherinoides*
Cyprinidae	*Cyprinidae*
Longnose Dace	*Rhinichthys cataractae*
Yellow Pickerel	*Stizostedion vitreum*
Burbot	*Lota lota*
Trout Perch	*Percopsis omiscomaycus* -
Channel Catfish	*Ictalurus punctatus*
Redhorse Sucker	*Moxostoma sp*
Smallmouth Bass	*Micropterus dolomieui*
Bluntnose Minnow	*Pimephales notatus*
Carp	*Cyprinus carpio*
Freshwater Drum	*Aplodinotus grunniens*
Rainbow Trout	*Salmo gairdneri*
Rock Bass	*Ambloplites rupestris*
Slimy Sculpin	*Cottus cognatus*
StoneCat	*Noturus flavus*
Lake Trout	*Salvelinus namaycush*
Cisco	*Coregonus artedii*
Mottled Sculpin	*Cottus bairdi*
Splake	*Salvelinus namaycush* x S.*fontinalis*
Chinnok Salmon	*Oncorhynchus tsawytscha*
Brown Bullhead	*Ictalarus nebulosus*
Coho Salmon	*Oncorhynchus kisutch*
White Bass	*Morone chrysops*
Nine-Spine Stickleback	*Pungitius pungitius*
Brown Trout	*Salmo trutta*
Black Crappie	*Pomoxis nigromaculatus*
Log Perch	*Percina caprodes*
Mimic Shiner	*Notropis volucellus*
Rosyface Shiner	*Notropis rubellus*
Golden Redhorse	*Moxostoma erythrurum*
Creek Chub	*Semotilus atromaculatus*

TABLE 3.3.2-3

Beach Seine Catch by Location
Bruce GS 'B' Preoperational Study - Year II - 1980
Lake Huron

Taxa	Douglas Point		Bruce 'B' Intake		Holmes Bay		Gunn Point		McRae Point		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Spottail Shiner	819	64.7	100	90.1	1345	84.8	3684	75.5	187	85.0	6135	76.1
Alewife	389	30.7			7	0.4	10	0.2	1	0.5	407	5.0
Yellow Perch	4	0.3			50	3.2	1148	23.5	1	0.5	1203	14.9
Lake Chub					2	0.1			3	1.4	5	<0.1
Smelt	1	<0.1			2	0.1			2	0.9	5	<0.1
Gizzard Shad	1	<0.1									1	<0.1
Emerald Shiner	44	3.5	3	2.7	5	0.3	5	0.1	2	0.9	59	9.7
Cyprinids			1	0.9	97	6.1	6	0.1			104	1.3
Longnose Dace	6	0.5	4	3.6	52	3.3	19	0.4	18	8.2	99	1.2
Trout Perch							1	<0.1			1	<0.1
Smallmouth Bass							5	0.1			5	<0.1
Bluntnose Minnow					24	1.5					24	0.3
Carp	1	<0.1									1	<0.1
Slimy Sculpin	1	<0.1			1	<0.1			3	1.4	5	<0.1
Mottled Sculpin							1	<0.1	2	0.9	3	<0.1
Nine-Spine Stickleback			1	0.9			1	<0.1			2	<0.1
Log Perch					1	<0.1					1	<0.1
Mimic Shiner			1	0.9							1	<0.1
Rosyface Shiner									1	0.5	1	<0.1
TOTAL	1266		110		1586		4880		220		8062	
No of Species	9		6		11		10		10		19	

Trap Net

Only 832 fish belonging to 13 species were taken by trap net. Longnose sucker was the main species taken by trap net and made up 54% of the catch followed by white sucker (22%) and alewife (10%).

Trap nets set at Gunn Point produced largest total numbers of fish (216) caught by this gear type (Table 3.3.2-4), followed by trap nets set at McRae Point (188), Holmes Bay (163), the Bruce 'B' discharge (133) and Douglas Point (132). A total of 7 species was identified in the trap net catch at Gunn Point, 9 at McRae Point, 8 at Holmes Bay, 6 at the Bruce 'B' discharge and 7 at Douglas Point.

Longnose sucker was the main species taken by trap net at the Bruce 'B' discharge (72%), Holmes Bay (55%) and McRae Point (72%) and was the second most common species taken at Gunn Point (38%) and Douglas Point (36%). Largest numbers of longnose suckers were taken by trap nets set at McRae Point (135). Lowest numbers of longnose suckers were taken by trap nets set at Douglas Point (48). White sucker was the most abundant species taken at Gunn Point (42%) and the second most common species caught by trap net at all the remaining locations except Douglas Point. Largest numbers of white suckers were taken by trap nets set at Gunn Point (90) and lowest numbers were taken at Douglas Point (7). Alewife was the main species taken by trap nets set at Douglas Point (51%). A total of 67 alewife was taken by trap net at that location. This species was not part of the trap net catch at Gunn Point and was taken in low numbers by trap nets set at the remaining locations (<12).

Gill Net

Gill net catch totalled 14 664 with 32 species being represented. Alewife was the main species taken and made up 39% of the gill net catch. Other abundant fish in gill net catch included longnose sucker (12%), lake chub (11%), smelt (11%), yellow perch (10%) and white sucker (8%). Many of the fish considered to be of economic or recreational importance were among the fish caught exclusively by gill net. Round whitefish, yellow pickerel (walleye), channel catfish, freshwater drum, rainbow trout, lake trout, cisco, splake, chinook salmon, coho salmon, brown trout, black crappie, and creek chub were taken only by gill net.

Largest numbers of fish caught by gill net were taken by nets set at Gunn Point (3049, Table 3.3.2-5), followed by nets set at McRae Point (2498), Holmes Bay (2479), the Bruce 'B' discharge (2326), and the Bruce 'B' intake (2325) while lowest numbers were taken by nets set at Douglas Point (1987). Twenty species were identified in the gill net catch at Gunn Point, 22 at McRae Point, 23 at Holmes Bay, 19 at the Bruce 'B' discharge and 21 each at the Bruce 'B' intake and Douglas Point.

TABLE 3.3.2-4

Trap Net Catch by Location
Bruce GS 'B' Preoperational Study - Year II - 1980
Lake Huron

Taxa	Douglas Point		Bruce 'B' Discharge		Holmes Bay		Gunn Point		McRae Point		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Alewife	67	50.8	2	1.5	12	7.4			4	2.1	85	10.2
Yellow Perch			7	5.3	1	0.6	29	13.4	7	3.7	44	5.3
Longnose Sucker	48	36.4	95	71.4	89	54.6	81	37.5	135	71.8	448	53.8
Lake Chub	1	0.8	2	1.5	16	9.8	9	4.2	3	1.6	31	3.7
White Sucker	7	5.3	25	18.8	31	19.0	90	41.7	29	15.4	182	21.9
Burbot							3	1.4			3	0.4
Redhorse Sucker									2	1.1	2	0.2
Smallmouth Bass					12	7.4	3	1.4	4	2.1	19	2.3
Carp					1	0.6					1	0.1
Rock Bass	1	0.8	2	1.5					2	1.1	5	0.6
Stone Cat					1	0.6			2	1.1	3	0.4
Brown Bullhead	1	0.8									1	0.1
Golden Redhorse	7	5.3					1	0.5			8	1.0
TOTAL	132		133		163		216		188		832	
No of Species	7		6		8		7		9		13	

TABLE 3.3.2-5

Gill Net Catch by Location
Bruce GS 'B' Preoperational Study - Year II, 1980
Lake Huron

Taxa	Douglas Point		Bruce 'B' Intake		Bruce 'B' Discharge		Holmes Bay		Gunn Point		McRae Point		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Spottail Shiner	18	0.9	14	0.6	283	12.2	58	2.3	42	1.4	28	1.1	443	3.0
Alewife	829	41.7	1074	46.2	876	37.7	673	27.1	1631	53.5	611	24.5	5694	38.8
Yellow Perch	103	5.2	182	7.8	176	7.6	308	12.4	233	7.6	519	20.8	1521	10.4
Longnose Sucker	268	13.5	231	9.9	246	10.6	246	9.9	341	11.2	394	15.8	1726	11.8
Lake Chub	162	8.2	301	12.9	338	14.5	271	10.9	218	7.1	354	14.2	1644	11.2
Smelt	349	17.6	212	9.1	104	4.5	495	20.0	224	7.3	205	8.2	1589	10.8
White Sucker	140	7.1	166	7.1	141	6.1	254	10.2	236	7.7	277	11.1	1214	8.3
Gizzard Shad	32	1.6	29	1.2	65	2.8	56	2.3	9	0.3	5	0.2	196	1.3
Round Whitefish	45	2.3	32	1.4	24	1.0	24	1.0	36	1.2	34	1.4	195	1.3
Emerald Shiner	2	0.1	10	0.4	17	0.7	24	1.0	5	0.2			58	0.4
Yellow Pickerel	12	0.6	24	1.0	15	0.6	4	0.2	5	0.2	17	0.7	77	0.5
Burbot	4	0.2	8	0.3	13	0.6	9	0.4	15	0.2	21	0.8	70	0.5
Trout Perch	5	0.3	8	0.3	8	0.3	23	0.9	7	0.2	9	0.4	60	0.4
Channel Catfish	5	0.3	14	0.6	9	0.4	7	0.3	13	0.4	5	0.2	53	0.4
Redhorse Sucker									1	<0.1			1	<0.1
Smallmouth Bass	1	<0.1	2	<0.1			3	0.1	3	<0.1	5	0.2	14	<0.1
Carp	1	<0.1	4	0.2	3	0.1	7	0.3			1	<0.1	16	0.1
Freshwater Drum	1	<0.1	5	0.2			2	<0.1			2	<0.1	10	<0.1
Rainbow Trout					1	<0.1	3	0.1	4	0.1	1	<0.1	9	<0.1
Rock Bass	1	<0.1											1	<0.1
Stone Cat	1	<0.1			1	<0.1					1	<0.1	3	<0.1
Lake Trout							1	<0.1			2	<0.1	3	<0.1
Cisco											3	0.1	3	<0.1
Splake					1	<0.1	1	<0.1					2	<0.1
Chinook Salmon									2	<0.1			2	<0.1
Brown Bullhead	1	<0.1											1	<0.1
Coho Salmon			1	<0.1			1	<0.1					2	<0.1
White Bass			1	<0.1							1	<0.1	2	<0.1
Brown Trout							1	<0.1					1	<0.1
Black Crappie			1	<0.1									1	<0.1
Golden Redhorse	7	0.4	6	0.3	5	0.2	8	0.3	8	0.3	3	0.1	37	0.3
Creek Chub									16	0.5			16	0.1
TOTAL	1987		2325		2326		2479		3049		2498		14664	
No of Species	21		21		19		23		20		22		32	

Alewife was the main species taken by gill net at all locations and made up between 25% (McRae Point) and 54% (Gunn Point) of the total gill net catch at the six locations. Largest numbers of alewife were taken by gill nets set at Gunn Point (1631), followed by the Bruce 'B' intake (1074), the Bruce 'B' discharge (876), Douglas Point (829), Holmes Bay (673) and McRae Point (611). Total gill net catch of longnose suckers was highest at McRae Point (394) and lowest at the Bruce 'B' intake (231). Gill net catch of lake chub was also highest at McRae Point (354) and was lowest at Douglas Point (162). Largest numbers of rainbow smelt were taken by gill nets set at Holmes Bay (495) and lowest in nets set at the Bruce 'B' discharge (104). Gill net catch of yellow perch was highest at McRae Point (519) and lowest at Douglas Point (103). White suckers were taken in largest numbers by gill nets set at McRae Point (277) and in lowest numbers at Douglas Point (140) and the Bruce 'B' discharge (141).

Spottail Shiner

Spottail shiners were collected mainly by beach seine and were the main species taken by this gear type. They were part of the beach seine catch from June through October (Figure 3.3.2-1) and were caught in largest numbers in late August. Catches of spottail shiner in August were highest at Gunn Point (CUE = 1217) followed by Holmes Bay (CUE = 437). With the exception of Douglas Point in October, catches were less than 50 fish per seine at all other locations and dates. The catch of spottail shiners at Douglas Point in October was 142 per seine. The spottail shiner, an important forage fish, is considered to be a fish of relatively large lakes and larger rivers that spawns in spring and early summer (Scott and Crossman, 1973). The large numbers of spottail shiners taken in the study area in August, after its spawning period, consisted mainly of young-of-the-year suggesting that Gunn Point and Holmes Bay are probably nursery areas.

Alewife

Alewife were collected mainly by gill net followed by beach seine while relatively few were taken by trap net. It was present in the gill net catch from May through October, part of the trap net catch from May through July and part of the beach seine catch from July through October. Largest beach seine catches of alewife were taken at Douglas Point in August (CUE = 85) and in late October (CUE = 44) (Figure 3.3.2-2A). Beach seine catch of alewife at the remaining locations was sporadic and low with no alewife taken by beach seines at the Bruce 'B' intake.

Almost all alewife caught by trap net were taken at Douglas Point in June (Figure 3.3.2-3A). The CUE for these trap nets was 17 alewife per trap. Alewife gill net catches were generally highest between June and August and lowest in September and October at all locations. Largest gill net catch of alewife was taken at Gunn Point in July (Figure 3.3.2-4). The CUE for these nets was 184 alewife per net. Large numbers of alewife were also collected by gill nets set at Gunn Point in May when the CUE was 167 although alewife catch at the remaining locations was relatively low in May. Largest gill net catch of alewife at Douglas

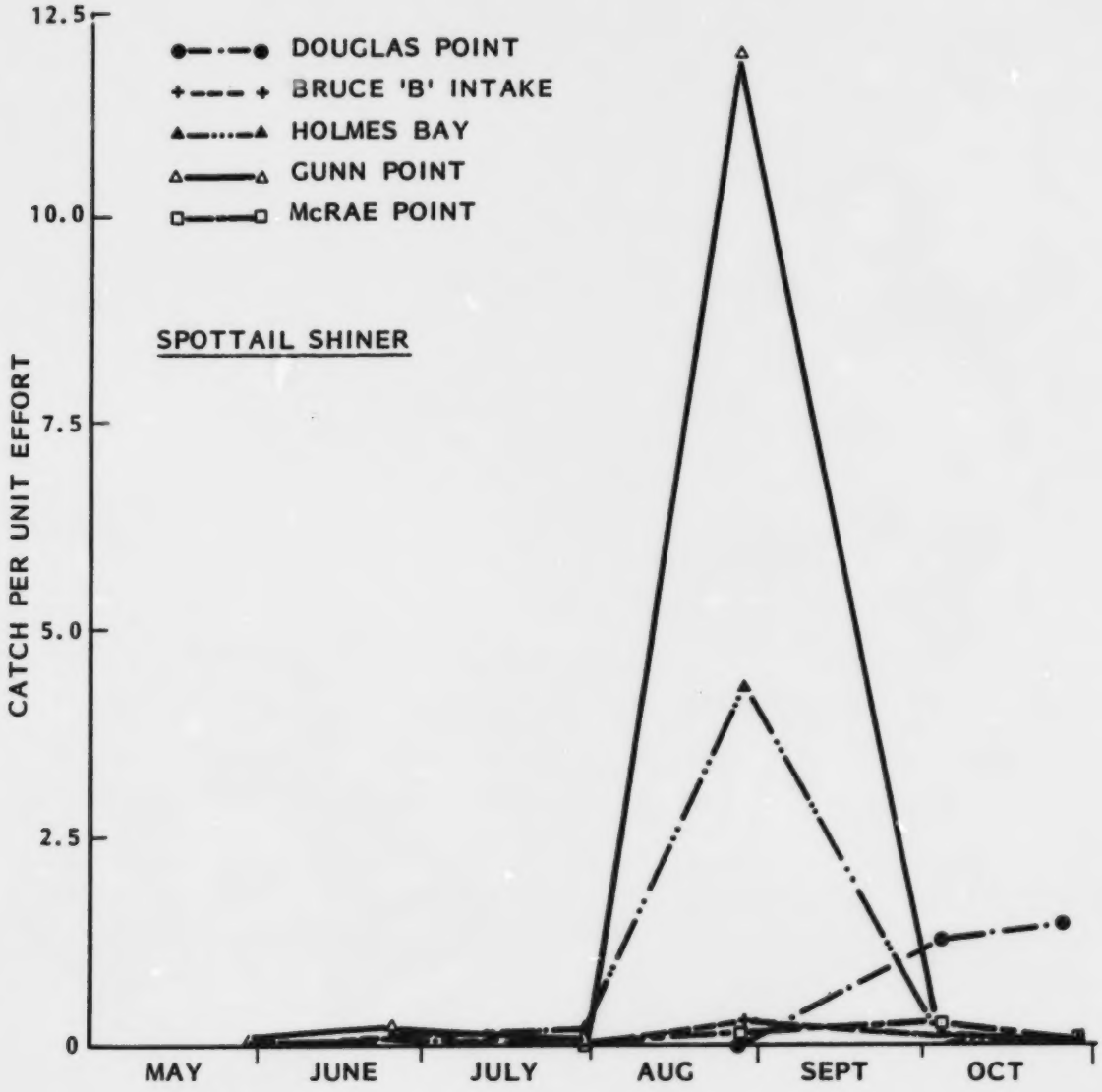

FIGURE 3.3.2-1

SEASONAL CATCH PER UNIT EFFORT OF SPOTTAIL SHINERS BY BEACH SEINE.
BRUCE 'B' GS PREOPERATIONAL STUDY - YEAR II, 1980
LAKE HURON

155788-RD

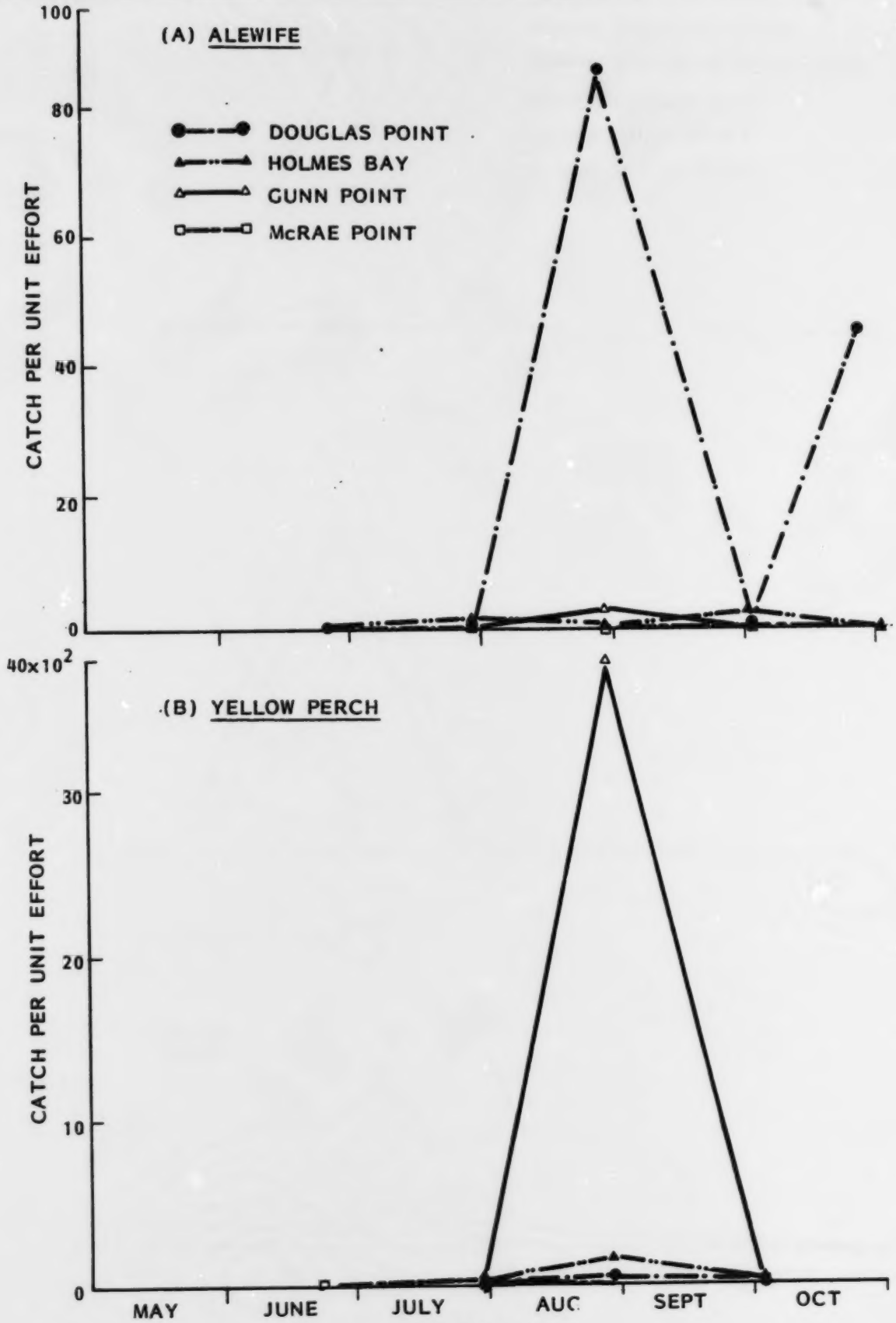

FIGURE 3.3.2-2

SEASONAL CATCH PER UNIT EFFORT FOR (A) ALEWIFE AND (B) YELLOW PERCH BY BEACH SEINE. BRUCE 'B' CS PREOPERATIONAL STUDY, YEAR II, 1980 LAKE HURON

155789-RD

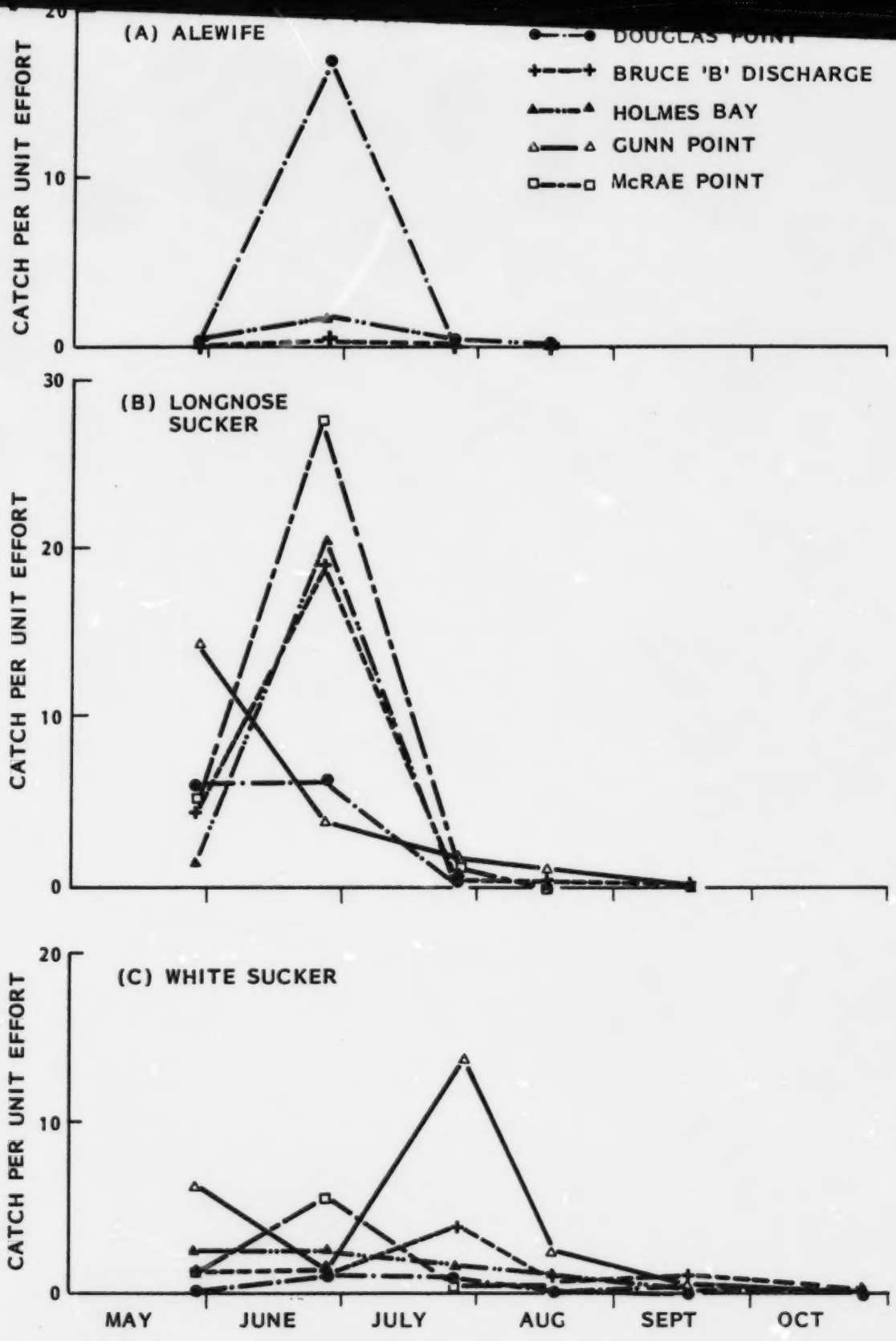

FIGURE 3.3.2-3

SEASONAL CATCH PER UNIT EFFORT OF (A) ALEWIFE, (B) LONGNOSE SUCKER (C) WHITE SUCKER BY TRAP NET. BRUCE 'B' GS PREOPERATIONAL STUDY YEAR II, 1980 - LAKE HURON

155790-RD

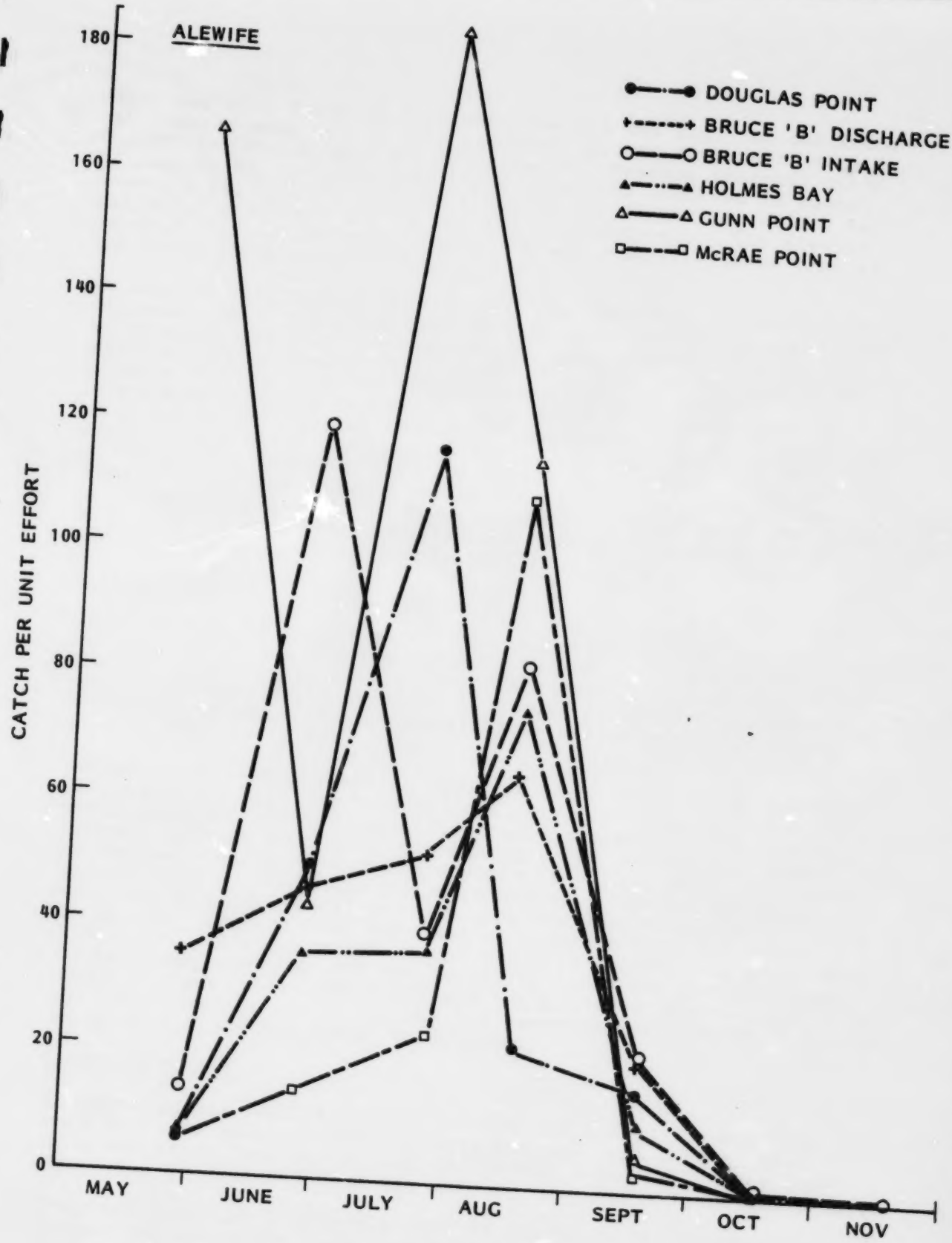

FIGURE 3.3.2-4
SEASONAL CATCH PER UNIT EFFORT OF ALEWIFE BY GILL NET.
BRUCE 'B' GS PREOPERATIONAL STUDY - YEAR II, 1980
LAKE HURON

155793-RD

Point was also taken in July when the CUE was 116. At the Bruce 'B' intake, nets set in June produced largest numbers of alewife. The CUE for these nets was 120 alewife. Maximum seasonal catch of alewife at the remaining three locations occurred in August when the gill net CUE at the Bruce GS 'B' discharge, Holmes Bay and McRae Point was 65, 76 and 109, respectively. The alewife catch at the latter three locations was generally lower than at the first three locations.

In Lake Ontario around Port Credit, Graham (1956, in Scott and Crossman, 1973) observed that alewife move inshore to spawn from April until mid July. At the Bay of Quinte (Lake Ontario) inshore migration lasted until late July. The large presence of alewife inshore from May through August in the Bruce GS 'B' study area probably represents an inshore spawning migration. In a larval fish survey conducted around the BNPD in 1980, larval alewife were first observed in early July and peaked in mid July (Ontario Hydro Research Division Report No 82-182-K). Most adult alewife leave the inshore waters and migrate to deeper waters after spawning usually in August (Graham, 1956) with the juvenile alewife believed to follow the same migration pattern as the adults (Scott and Crossman, 1975).

Yellow Perch

Large numbers of yellow perch were collected both by beach seine and gill net. Beach seine catch of yellow perch was generally limited to August at Gunn Point (CUE = 383). Most of the yellow perch collected by beach seine in August were young-of-the-year. According to Scott and Crossman (1973) yellow perch may spawn anytime from April into July.

Yellow perch were present in gill net catch from May to November (Figure 3.3.2-5A). Maximum seasonal catch at each of the locations where gill nets were set varied considerably. Generally, largest numbers were taken between June and October and lowest in May and November. Largest numbers of yellow perch were taken by gill nets set at McRae Point in August. The CUE for these nets was 51 yellow perch per net. Second largest catch of yellow perch were taken in gill nets set at Holmes Bay in September (CUE = 38). Maximum catch at the Bruce 'B' intake was also taken in September when the CUE was 20 yellow perch per net. Largest catch at Gunn Point (CUE = 27) and the Bruce 'B' discharge (CUE = 15) were taken in June. At Douglas Point largest number of yellow perch (CUE = 11) was taken in October.

Longnose Sucker

Longnose sucker were collected by trap net and gill net. They were the main species taken by trap net and were part of the trap net catch from May to August (Figure 3.3.2-3B). They were collected by gill net from May through November (Figure 3.3.2-5B).

Trap net catch of longnose sucker at the Bruce 'B' discharge, Holmes Bay and McRae Point was highest in June with largest numbers collected at McRae Point. The CUE for trap nets set at the Bruce 'B' discharge, Holmes Bay and McRae Point in June was 19, 21 and 28 longnose suckers per trap, respectively. In trap nets set at Gunn Point they were collected in largest numbers in May

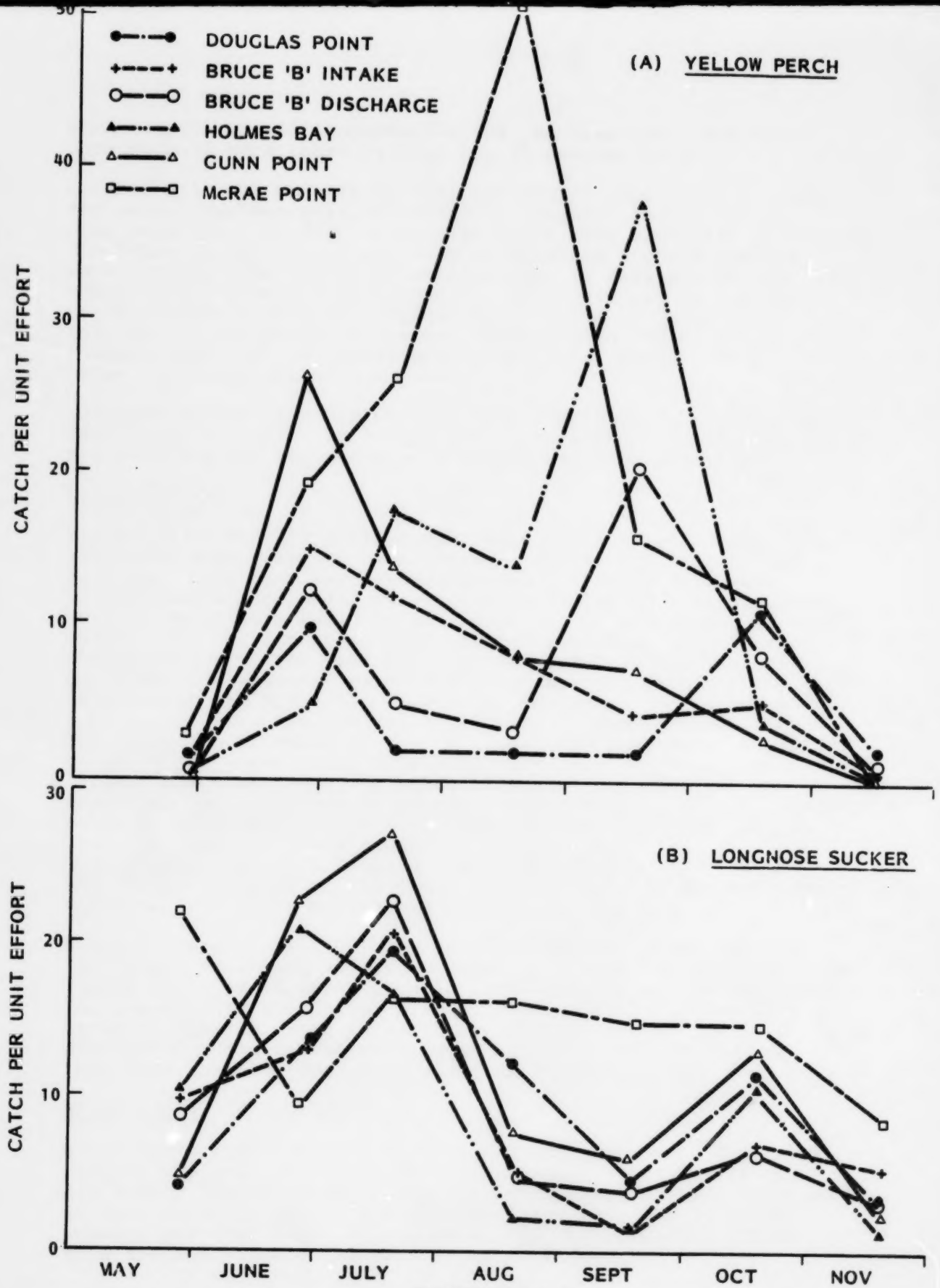

FIGURE 3.3.2-5
SEASONAL CATCH PER UNIT EFFORT OF (A) YELLOW PERCH AND (B) LONGNOSE SUCKER BY GILL NET. BRUCE 'B' GS PREOPERATIONAL STUDY - YEAR II, 1980 - LAKE HURON

155791-RD

when the CUE was 15 longnose suckers per trap net. Few longnose suckers were taken by trap net at Douglas Point.

Largest gill net catches of longnose sucker were taken in June and July. Maximum seasonal catch of longnose sucker in gill nets were taken in July at Douglas Point, the Bruce 'B' discharge, the Bruce GS 'B' intake and Gunn Point where highest numbers were caught. The CUE at these locations in July was 20, 21, 23 and 27 respectively. At Holmes Bay gill nets set in June produced largest number of longnose suckers and at McRae Point gill nets set in May produced largest numbers with CUE of 21 and 22 respectively. At all locations except McRae Point, the gill net catch increased again in October.

Longnose sucker spawn in shallow areas of lakes in the spring (Scott and Crossman, 1973) and the large numbers caught between May and July may represent part of the spawning migration.

Rainbow Smelt

All but 5 of the 159 smelt caught were taken by gill net. The remaining were taken by beach seine. Smelt were part of the gill net catch from May through November (Figure 3.3.2-6A). Largest numbers of smelt were taken in September. Largest numbers of smelt were taken by gill nets set at Holmes Bay in September. The CUE for these nets was 143 smelt per net. During the remainder of the year smelt catch at Holmes Bay was very low. Maximum seasonal catch was also taken in September by gill nets set at the Bruce 'B' discharge, the Bruce 'B' intake and Gunn Point where the CUE was 19, 27 and 37 respectively. With the exception of smelt caught in August and September, numbers taken at the above three locations were low. At McRae Point, largest seasonal catch was taken in August when the CUE was 26 smelt per net. At Douglas Point, largest numbers of smelt were taken by gill nets set in May. The CUE for these nets was 91 smelt per net. Numbers caught at Douglas Point from June to August were low and increased again in September when the CUE was 37 smelt per net. The catch was low again in October and November just as it was at the remaining locations.

Rainbow smelt generally spawn sometime between March and May (Scott and Crossman, 1973). Douglas Point was the only location fished where smelt were taken in large numbers during the spawning season. In the larval fish survey conducted around BNPD in 1980 (Ontario Hydro Research Division Report No 82-182-K). Large numbers of smelt larvae were found in early June indicating that some spawning does take place in the study area.

White Sucker

White suckers were caught by trap net and gill net. They were part of the trap net catch from May through September (Figure 3.3.2-3C). Catch of white suckers was highest in trap nets set at Gunn Point in July. The CUE for these nets was 14 white suckers per trap net. At the remaining locations the CUE of this species was low all year round (CUE <6).

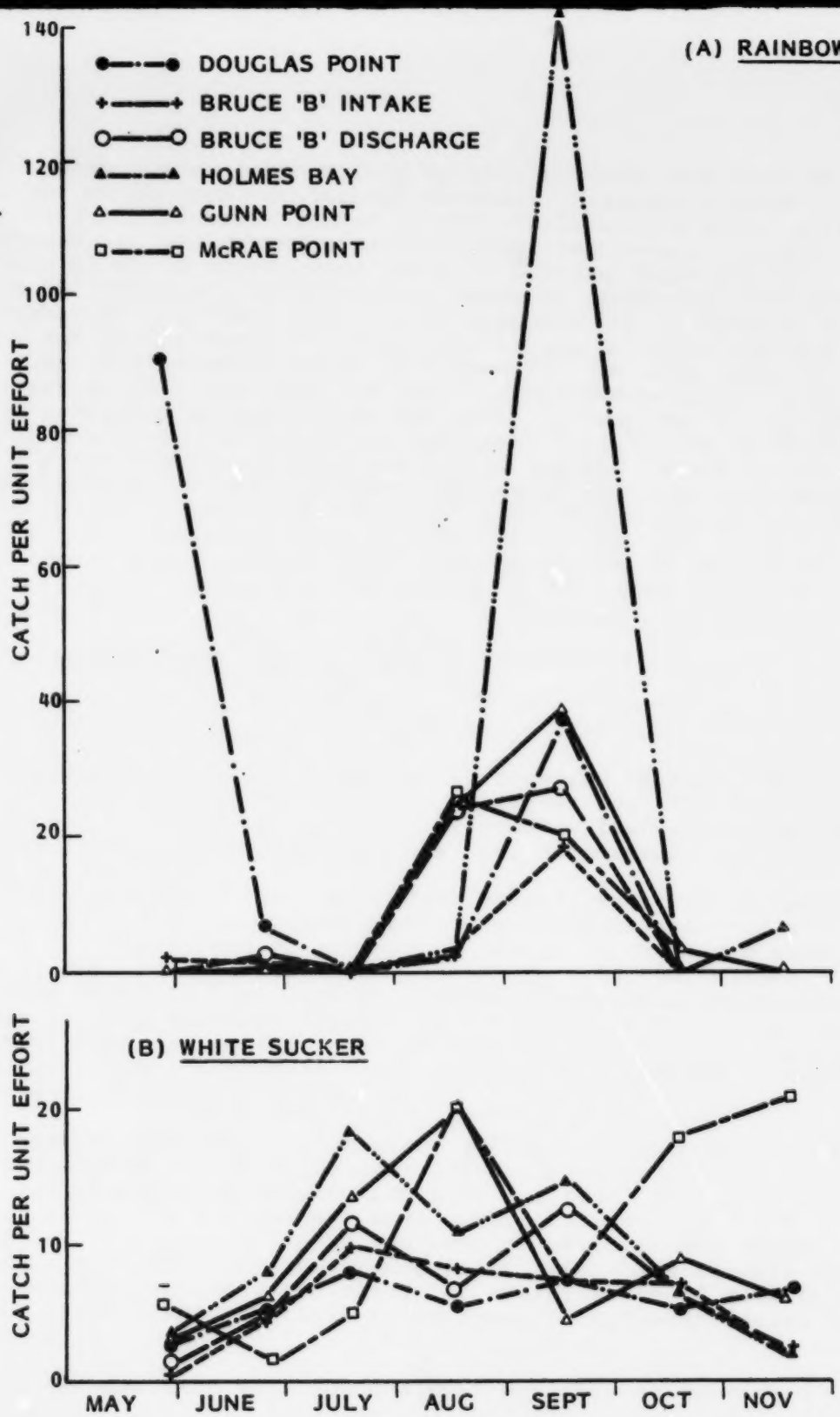

FIGURE 3.3.2-6

SEASONAL CATCH PER UNIT EFFORT (A) RAINBOW SMELT AND (B) WHITE SUCKER BY GILL NET. BRUCE 'B' GS, 1980 LAKE HURON

155792-RD

White suckers were taken mainly by gill net and were part of the gill net catch from May through November (Figure 3.3.2-6B). Largest catch of white sucker at the six locations where gill nets were set was taken between July and September. Lowest numbers of white sucker were taken at Douglas Point and the Bruce 'B' discharge. The highest catch at these two locations was taken by gill nets set in July when the CUE at Douglas Point was 8 and at the Bruce 'B' discharge it was 10 white suckers per net. Maximum seasonal catch at Holmes Bay was also taken by nets set in July when the CUE was 18. Maximum seasonal catch of this species at Gunn Point was taken by nets set in August and at the Bruce 'B' intake it was taken by nets set in September. The CUE for the former nets was 20 and for the latter it was 13 white suckers per net. Largest numbers of white suckers were taken by gill nets set at McRae Point in November when the CUE was 21. White suckers usually spawn from early May to early June (Scott and Crossman, 1973) such that most of the white suckers caught during the study period were caught after their spawning period.

3.3.3 Acoustic Fish Census

Day

The acoustic census day sample which appeared to have the highest overall fish density was obtained on August 19. The August sample was followed, in order of descending fish abundance, by samples taken on July 22, September 18, November 27 and May 27.

The horizontal distribution of fish echoes was generally patchy. The areas of greatest concentration were inconsistent from sample to sample, and no alongshore trends in abundance were readily apparent. In contrast, there was a marked inshore-offshore trend in fish echo abundance. These were concentrated in the mid and offshore regions of the grid, in relatively deep waters. This was particularly evident in the July and August samples, where a number of large schools were located at depths in excess of 15 m.

Two types of aggregation patterns (schools) were observed. Relatively loose aggregations and elliptical schools (long axis vertical on echograms) extending from (or near) bottom to several meters above the bottom were most common between the 5 and 27 m contours. At greater depths aggregation which formed dense layers close to the bottom predominated. For Lake Ontario similar echo aggregations were indicative of the presence of alewife and smelt, respectively (Ontario Hydro Research Division Report No 80-197-K).

During the day fish were found almost entirely on or within 6 m of bottom.

Night

The July 22 and September 15 night samples appeared to have substantially lower numbers of fish than the May and June samples. Numbers of echoes generally appeared to be lower than in the corresponding day samples.

No trends in fish abundance with position alongshore or distance from shore were apparent in the echograms. As in day samples, highest echo concentrations generally appeared close to the bottom. Appreciable numbers of midwater echoes were found only in the July and September samples. In the July samples these were in a diffuse layer at a depth of 14-18 m, while in September they were less localized vertically and somewhat fewer in number.

Fish Species Composition

Longnose sucker, lake chub and alewife were the fish species most frequently taken in conjunction with acoustic census. Nets set in the area of large schools in August produced exclusively alewife at 20 m and smelt at 30 m.

3.3.4 Round Whitefish

Fishing was scheduled for the collection of round whitefish in November and December. Nets were set for 24 hours but due to weather conditions, nets set in December remained in the water for 144 hours. Those latter nets were not included in the following analyses.

During the November sets 51 round whitefish were caught representing a catch per net of 1.1 fish or a catch of 0.2 per 25 yds of gill net (1.5 to 5.0 inch mesh). Relatively large numbers of round whitefish were caught in September (2.8 per gill net, 0.5 per 25 yds) and October (2.1 per gill net, 0.4 per 25 yds). The catch per unit effort at BNPD was similar to catches in Lake Ontario near Pickering GS (1980 Pickering 'B' Preoperational Survey Report No 82-460-K).

The catches of round whitefish at the sampling locations were presented in Table 3.3.4-1. In September largest catches were in the nets set at the 12 m depth at each location except Gunn and McRae Points. In October and November, the whitefish moved inshore with largest catches at all locations in the nets set at the 3 m depth.

In September largest catches were recorded in 12 m nets at Douglas Point (1.3 fish per 25 yds), Bruce 'B' discharge (1.2 per 25 yds) and Bruce 'B' intake (0.9 per 25 yds). In October, largest catches were from nets set at 3 m at Douglas Point (1.3 per 25 yds), Bruce 'B' intake (1.2 per 25 yds) and Holmes Bay (0.9 per 25 yds). Largest catches in November were in 3 m nets set at McRae Point (1.8 per 25 yds).

TABLE 3.3.4-1

Catch of Round Whitefish - Bruce 'B'
September-November 1980

	Location												TOTAL	
	Douglas Point		Bruce 'B' Discharge		Bruce 'B' Intake		Holmes Bay		Gunn Point		McRae Point			
	3 m	12 m	3 m	12 m	3 m	12 m	3 m	12 m	3 m	12 m	3 m	12 m	3 m	12 m
September														
Number Caught	5	14	2	12	4	9	2	6	4	1	7	2	24	44
Catch per Net	2.5	7.0	1.0	6.0	2.0	4.5	1.0	3.0	2.0	0.5	3.5	1.0	1.0	1.8
Catch per 25 yds (1.5"-5.0" mesh)	0.5	1.3	0.2	1.2	0.4	0.9	0.2	0.6	0.4	0.1	0.7	0.2	0.2	0.3
October														
Number Caught	14	1	1	0	6	0	9	0	7	1	4	0	41	2
Catch per Net	7.0	0.5	0.5	0.0	6.0	0.0	4.5	0.0	3.5	0.5	2.0	0.0	2.0	0.1
Catch per 25 yds	1.3	0.1	0.1	0.0	1.2	0.0	0.9	0.0	0.7	0.1	0.4	0.0	0.4	0.0
November														
Number Caught	5	1	3	1	8	0	3	2	8	1	19	0	46	5
Catch per Net	2.5	0.5	1.5	0.5	4.0	0.0	1.5	1.0	4.0	0.5	9.5	0.0	1.9	0.2
Catch per 25 yds	0.5	0.1	0.3	0.1	0.8	0.0	0.3	0.2	0.8	0.1	1.8	0.0	0.4	0.0
TOTAL														
Number Caught	24	16	6	13	18	9	14	8	19	3	30	2	111	51
Catch per Net	4.0	2.7	1.0	2.6	3.0	1.8	2.3	1.6	3.2	0.5	5.0	0.3	1.6	0.7
Catch per 25 yds	0.8	0.5	0.2	0.5	0.6	0.3	0.4	0.3	0.6	0.1	1.0	0.1	0.3	0.1

Ripe and post-spawn individuals were included among those round whitefish collected on November 20 and 24 only, the last two sampling dates. The ripe round whitefish were collected at the three most southerly transects, Holmes Bay (3 m, 1 fish), Gunn Point (3 m, 1 fish) and McRae Point (3 m, 5 fish). Post-spawn individuals were caught at Gunn Point (3 m, 3 fish) and McRae Point (3 m, 5 fish). Most other round whitefish collected in November were mature but reproductive products were not flowing. The presence of gravid and post-spawn individuals at the three southerly locations suggests that spawning occurs in those areas. Temperatures at those locations were 6° or 7°C.

The ages of round whitefish collected during this study ranged from 0+ to 8+ (Figure 3.3.4-1). The 1974 class (age 6+) was the most abundant cohort in the sample with substantial contributions from the 1975 (age 5+), 1977 (age 3+) and 1973 (age 7+) year classes. All but one of the round whitefish that were less than 3 years old were immature and almost all individuals 3 or more years old were mature (Table 3.3.4-2). The ripe and post-spawn individuals ranged from 2+ to 8+ years of age.

Growth curves for round whitefish collected during this study are in Figure 3.3.4-2. Growth curves of round whitefish from other areas are included for comparative purposes. As no growth is anticipated through the winter months, size of a fish at capture in the fall is assumed to be the same as the size of that fish when the next annulus is formed (for example, size at age 3+ = size at age 4). Where total length was utilized in the growth analysis of other studies, the fork-lengths were approximated using the formula of Healy (1975) for lake whitefish. The growth of round whitefish at BNPD was very similar to that of round whitefish from northern Lake Michigan (Mrza, 1964) and substantially higher than those of round whitefish from Lake Superior (Bailey, 1963) and from Ungawa (MacKay and Power, 1973). Growth of round whitefish from Lake Ontario was slightly faster than at BNPD (Ontario Hydro Research Division Report No 80-371-K and in preparation).

3.3.5 Winter Fish Survey

Winter fishing was conducted by gill net between March 31 and April 2, 1981. Other scheduled sets were cancelled due to weather. Shallow nets (3-5 m depth) and deep nets (12-15 m) were set at Douglas Point, the Bruce 'B' intake, the Bruce 'B' discharge, Gunn Point and McRae Point while shallow nets only were set at Holmes Bay. The numbers of fish and species composition of the fish collected are presented in Table 3.3.5-1.

A total of 1273 fish belonging to 14 species was taken. Gizzard shad was the main species collected and made up 52% (665 gizzard shad) of the total catch. Alewife was the second most abundant species contributing to 15% (188) of the catch followed closely by longnose sucker which made up 14% (176) of the catch. Other species which contributed to more than 1% of the total catch were white sucker (8%), round whitefish (4%), lake chub (2%), burbot (2%) and yellow perch (1%).

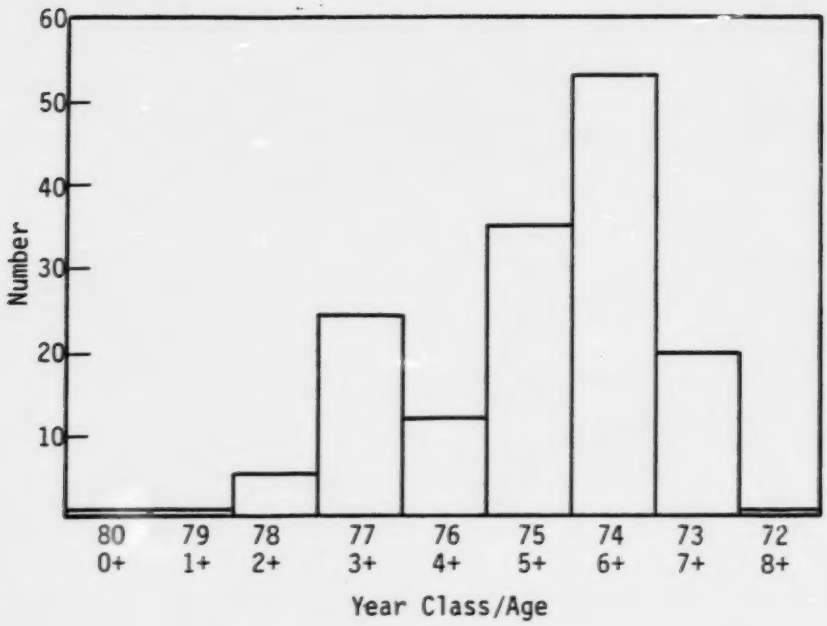

FIGURE 3.3.4-1

AGE DISTRIBUTION OF ROUND WHITEFISH
CAUGHT AT BRUCE G.S. 'B' SEPTEMBER - NOVEMBER 1980

TABLE 3.3.4-2

Age and Maturity of Round Whitefish
Bruce 'B' - 1980

		0+	1+	2+	3+	4+	5+	6+	7+	8+
Mature	No	0	0	1	20	11	33	53	19	1
	%	0.0	0.0	20.0	83.3	91.7	97.1	98.1	95.0	100.0
Immature	No	1	1	4	4	1	1	1	1	0
	%	100.0	100.0	80.0	16.7	8.3	2.9	1.9	5.0	0.0

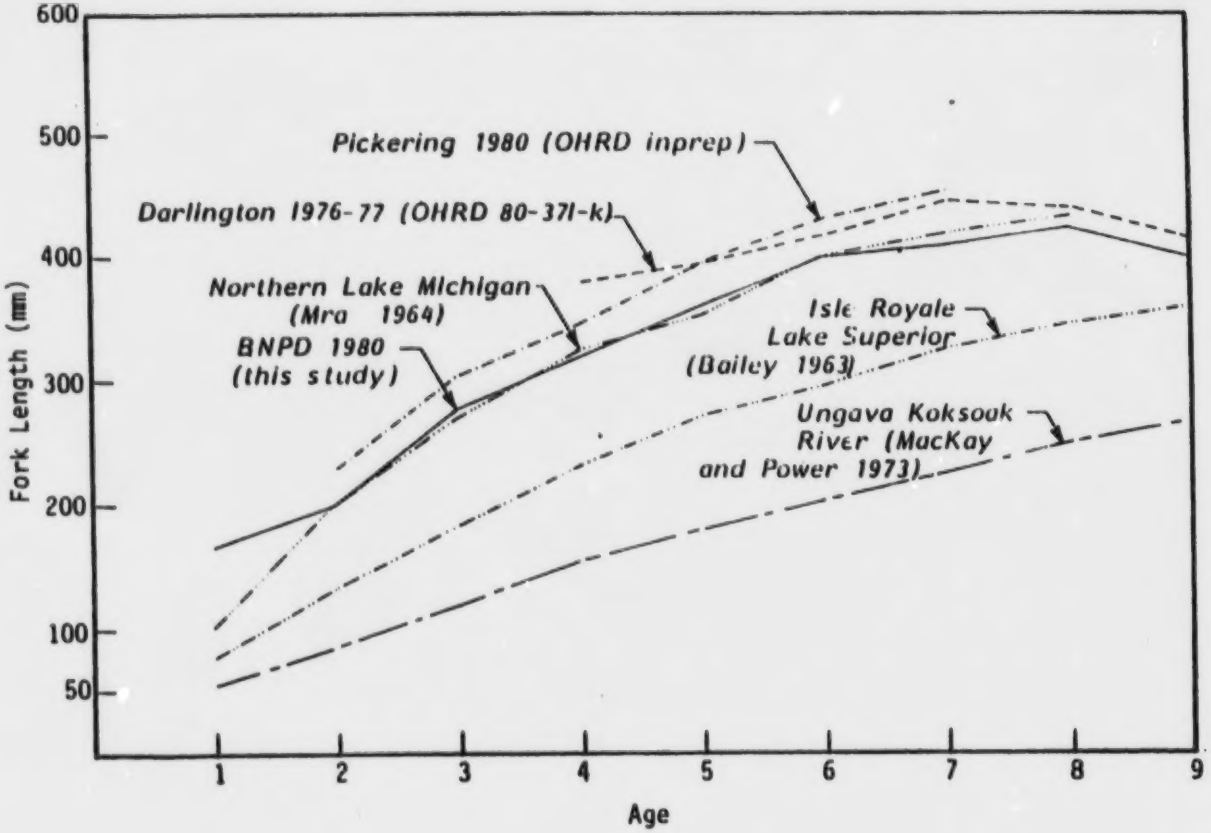

FIGURE 3.3.4-2
GROWTH CURVE OF ROUND WHITEFISH
BRUCE GS 'B' - 1980

TABLE 3.3.5-1

Species Composition of Fish Collected by Gill Nets Set on March 31, April 1 and April 2, 1981
Bruce GS 'B' Preoperational Study - Year II - Lake Huron

Species	Total	Percent
Gizzard Shad	665	52.2
Alewife	188	14.8
Longnose Sucker	176	13.8
White Sucker	101	7.9
Round Whitefish	49	3.9
Lake Chub	30	2.4
Burbot	28	2.2
Yellow Perch	13	1.0
Coho Salmon	10	0.8
Rainbow Trout	5	0.4
Chinook Salmon	4	0.3
Brown Trout	2	0.2
Carp	1	0.1
Smelt	1	0.1
	1273	

The four main species taken in both sets of samples are all spring spawners. Gizzard shad is apparently the earliest spawner. Miller (1960, in Scott and Crossman, 1973) noted that spawning of this species may start as early as mid-March.

Fish catch by location is presented in Table 3.3.5-2. Since only shallow nets were set at Holmes Bay, the data for this location will not be included in the discussion on the spatial distribution of the fish and will be discussed separately. At the remaining locations, largest numbers of fish were taken at the Bruce 'B' discharge (299) followed closely by the Bruce 'B' intake (292), and then Gunn Point (268) and Douglas Point (211) while lowest numbers were caught at McRae Point (163). Gizzard shad was the main species caught at the Bruce 'B' intake (59%), the Bruce 'B' discharge (79%) and Gunn Point (65%), and the second most common species taken at Douglas Point (18%) and McRae Point (18%). Alewife was the main species caught at Douglas Point (41%) while longnose sucker was the main species taken at McRae Point (31%).

Largest numbers of gizzard shad were caught at the Bruce 'B' discharge (236, CUE = 59), followed by Gunn Point (174 = CUE = 44) and the Bruce 'B' intake (172, CUE = 43) while substantially lower numbers were taken at Douglas Point (38, CUE = 10) and McRae Point (30, CUE = 8). Alewife catch was highest at Douglas Point (86, CUE = 22) and lowest at the Bruce 'B' discharge where only two alewife (CUE = 0.5) were taken. Longnose sucker were taken in largest numbers at McRae Point (51, CUE = 13) and lowest numbers at the Bruce 'B' intake (26, CUE = 7). Largest numbers of white sucker were also taken at McRae Point (24, CUE = 6) and lowest numbers were taken at Gunn Point (15, CUE = 4).

A total of 40 fish belonging to 5 species was collected at Holmes Bay. Gizzard shad was the main species taken and made up 38% (15, CUE = 8) of the catch. Alewife was the second most abundant species present representing 33% of the catch (13, CUE = 7).

3.3.6 Nesting Larid Study

The Bruce GS 'B' construction site was observed for nesting larids in May coincident with the Bruce 'A' GS survey (Ontario Hydro Research Division Report - in draft). No nesting larids were found on the site during these observations. Construction activity was observed on or near the landfill and armour areas surveyed. With a decrease in construction activity the colonization of these sites may occur.

4.0 SUMMARY

1.0 Substrate

The substrate in the vicinity of the Bruce 'B' GS is heterogeneous. Bedrock is the dominant substrate type with cobble and boulder present in lower percentages.

2.0 Sedimentation

Sedimentation was greatest in the July-September sampling period with the greatest deposition along the 7 m contour. Sedimentation was highest along the Holmes Bay transect.

TABLE 3.3.5-2

Species Composition of Fish Collected on March 31, April 1 and April 2, 1981 at Each Location Bruce GS 'B' Preoperational Study - Year II Lake Huron

Species	Douglas Point		Bruce 'B' Intake		Bruce 'B' Discharge		[1]Holmes Bay		Gunn Point		McRae Point	
	No	%	No	%	No	%	No	%	No	%	No	%
Gizzard Shad	38	18.0	172	58.9	236	78.9	15	37.5	174	64.9	30	18.4
Alewife	86	40.8	55	18.8	2	0.7	13	32.5	17	6.3	15	9.2
Longnose Sucker	27	12.8	26	8.9	27	9.0	7	17.5	38	14.2	51	31.3
White Sucker	23	10.9	19	6.5	18	6.0	2	5.0	15	5.6	24	14.7
Round Whitefish	17	8.1	5	1.7	4	1.3			10	3.7	13	8.0
Lake Chub	6	2.8	9	3.1	2	0.7			1	0.4	12	7.4
Burbot	2	0.9	2	0.7	4	1.3	3	7.5	9	3.4	8	4.9
Yellow Perch	4	1.9	1	0.3	1	0.3			1	0.4	6	3.7
Coho Salmon	2	0.9	2	0.7	3	0.1			2	0.8	1	0.6
Rainbow Trout	2	0.9			2	0.7			1	0.4		
Chinook Salmon	3	1.4									1	0.6
Brown Trout			1	0.3							1	0.6
Carp	1											
Smelt											1	0.6
TOTAL	211		292		299		40		268		163	
No of Species	12		10		10		5		10		12	

[1]Shallow nets only.

3.0 Temperature

The water temperature fluctuated throughout the monitoring periods. Highest temperatures were recorded in August. August was also the month of a major cold water influx.

4.0 Water Chemistry

The levels of the water quality parameters measured during the study period were generally indicative of an unpolluted environment. The dissolved solids to conductivity ratio was typical of water free of industrial waste. The water was moderately basic with pH 8.1 - 8.4. Any trends that were obvious in the levels of the parameters measured were seasonal rather than spatial. Of these parameters specific conductance was highest in September, pH was lowest in October and the biological oxygen demand was highest in May.

5.0 Ichthyoplankton

Rainbow smelt larvae were the main larvae collected in Holmes Bay (78%) and Inverhuron Bay (67%) and Alewife larvae were the second most abundant larvae collected (14 and 25% respectively). Maximum densities of rainbow smelt larvae were found on May 23 when their densities were estimated to be 1920/1,000 m^3 in Holmes Bay and 1660/1,000 m^3 in Inverhuron Bay. Maximum densities of alewife were found in late July when their densities were estimated to be 1353 and 695/1,000 m^3 respectively.

6.0 Adult and Juvenile Fish

A total of 23,558 fish were collected by beach seine, trap net and gill net. The main species taken were spottail shiner and alewife which contributed to 28 and 26% of the total catch respectively. Other abundant species of which at least 200 specimens were caught included: yellow perch, longnose sucker, lake chub, rainbow smelt and white sucker. Spottail shiner was the main species taken by beach seine, longnose sucker was the main species taken by trap net and alewife was the main species taken by gill net. All three gear types produced largest number of fish at Gunn Point.

Largest number of spottail shiners taken by beach seine were caught at Gunn Point in August (CUE =1217). Along shore where beach seining was conducted, alewife were caught in largest numbers at Douglas Point in August (CUE = 85) while in deeper waters where gill nets were set maximum catch was obtained at Gunn Point in July (CUE = 184). Most of the yellow perch taken by beach seine were caught at Gunn Point in August (CUE = 383). Largest number of yellow perch caught by gill nets were taken by nets set at McRae Point in August (CUE = 51). Maximum catch of longnose sucker was taken by trap nets set at McRae Point in June (CUE = 28). Rainbow smelt were collected almost exclusively by gill nets with largest catch taken by nets set at Holmes Bay in September (CUE = 143). White sucker were also mainly taken by gill net with highest catch taken by nets set at McRae Point in November (CUE = 21).

7.0 Whitefish Spawning Study

Round whitefish were collected during September, October and November. Largest catches in September were from 12 m depths at Douglas Point, Bruce 'B' discharge, and Bruce 'B' intake. In October largest catches were from the 3 m depths at Douglas Point, Bruce 'B' intake and Holmes Bay. Largest catches in November were taken at the 3 m depth at McRae Point. Gravid and post-spawn individuals were collected on November 20 and 24 at the three most southerly sampling locations (Holmes Bay, Gunn Point and McRae Point) at water temperatures of 6-7°C. The 1974 year class (age 6+) was the strongest cohort and most individuals 3 or more years old were mature. Growth of round whitefish from BNPD was similar to that of round whitefish from northern Lake Michigan and intermediate between Lake Ontario and Lake Superior.

8.0 Winter Fish Survey

A total of 1,273 fish belonging to 14 species were collected by gill nets between March 31 and April 2, 1981. Gizzard shad was the main species taken (52%) followed by alewife (15%) and longnose sucker (14%). Excluding Holmes Bay, largest numbers of fish were taken by nets set at the Bruce 'B' discharge (299) while lowest numbers were taken at McRae Point (163).

9.0 Nesting Larid Studies

No larid nests were located on the Bruce GS 'B' site.

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Submitted:

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Biological Research Section

RWS:ta

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APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

Douglas Pt

Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A			52	4	24	20	
	B			74	23	3		
	C		46	44	10			
	$\bar{X}$		15	57	12	9	7	
3m	A	100						
	B	100		5	7			
	C	88		2	2			
	$\bar{X}$	96						
7m	A	100		38	29			
	B	33						
	C	100		13	10			
	$\bar{X}$	77						
12m	A	100						
	B	100		4	4			
	C	92		1	1			
	$\bar{X}$	98						

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

Lagoon Bay								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A			9	91			
	B			100				
	C		68	8	24			
	$\bar{X}$		23	39	38			
3m	A		65	27	8			
	B	87		6	3	4		
	C	17		75	8			
	$\bar{X}$	35	22	36	6	1		
7m	A	100						
	B	28		72				
	C	80	20					
	$\bar{X}$	69	7	24				
12m	A			91	9			
	B	93			7			
	C			57	28	6	9	
	$\bar{X}$	31		49	15	2	3	

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

Bruce GS 'B' Discharge								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A		100					
	B		100					
	C		100					
	$\bar{X}$		100					
3m	A		93	7				
	B		93	2				
	C							
	$\bar{X}$		96	4				
7m	A		18	64	11	7		
	B	48		32	17	3		
	C		29	47	30	4		
	$\bar{X}$	16	16	44	19	5		
12m	A		62	38				
	B	100						
	C		37	28	30	5		
	$\bar{X}$	33	33	22	10	2		

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

Bruce GS 'B' Intake								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A			53	27	40		
	B	65		20	15			
	C			64	36			
	$\bar{X}$	22		39	26	13		
3m	A	35		51	10	4		
	B	27		45	14	14		
	C	20		50	18	12		
	$\bar{X}$	27		49	14	10		
7m	A		67	8	22	3		
	B		85	3	6		6	
	C	15	19	36	21	9		
	$\bar{X}$	5	54	19	16	4	2	
12m	A		60	17	15	8		
	B		33	36	26	1	4	
	C			88	10		2	
	$\bar{X}$		31	47	17	3	2	

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

South Boundry Point								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A			43	20	37		
	B			55	40	5		
	C			34	46	20		
	$\bar{X}$			44	35	21		
3m	A	53		30	14	1	2	
	B	91		9				
	C	85		14		1		
	$\bar{X}$	75		18	5	1	1	
7m	A	94		4	2			
	B		30	58	7	5		
	C	27		3				
	$\bar{X}$	63	10	22	3	2		
12m	A	55		28	10	4	3	
	B		28	30	32	6	4	
	C		50	15	30	5		
	$\bar{X}$	18	26	25	24	5	2	

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

Holmes Bay								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A				85	15		
	B					100		
	C				3	97		
	$\bar{X}$				44	56		
3m	A			21	66	4	9	
	B			100				
	C			24	76			
	$\bar{X}$			48	48	1	3	
7m	A	100						
	B	100						
	C	100						
	$\bar{X}$	100						
12m	A							
	B		30	60	2	8		
	C			50	46	4		
	$\bar{X}$		15	55	24	6		

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

Gunn Pt								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A			37	50	13		
	B			45	45	10		
	C			40	52	8		
	$\bar{X}$			41	49	10		
3m	A	100						
	B	100						
	C	100						
	$\bar{X}$	100						
7m	A		44	26	30			
	B			51	49			
	C			21	65	10	4	
	$\bar{X}$		15	33	48	3	1	
12m	A		5	11	84			
	B			75	20	5		
	C		72		28			
	$\bar{X}$		26	29	43	2		

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

Inverhuron Bay								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A					5	95	
	B				9	3	88	
	C				10		90	
	$\bar{X}$				6	3	91	
3m	A	90			6	4		
	B	100						
	C	39		8	50	3		
	$\bar{X}$	76		3	19	2		
7m	A		100					
	B	100						
	C	40		55	4		1	
	$\bar{X}$	49	33	16	1		1	
12m	A						100	
	B						100	
	C						100	
	$\bar{X}$						100	

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

McRae Pt								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
Shoreline	A			24	65	11		
	B	100						
	C		75	5	20			
	$\bar{X}$	33	25	10	28	4		
3m	A		55	22	19	4		
	B	100						
	C	41	35	8	16			
	$\bar{X}$	47	30	10	12	1		
7m	A		72	11	3	15		
	B		37	55	8			
	C		6	77	17			
	$\bar{X}$		38	48	9	5		
12m	A			50	50			
	B			64	36			
	C	24		72	4			
	$\bar{X}$	8		62	30			

APPENDIX A

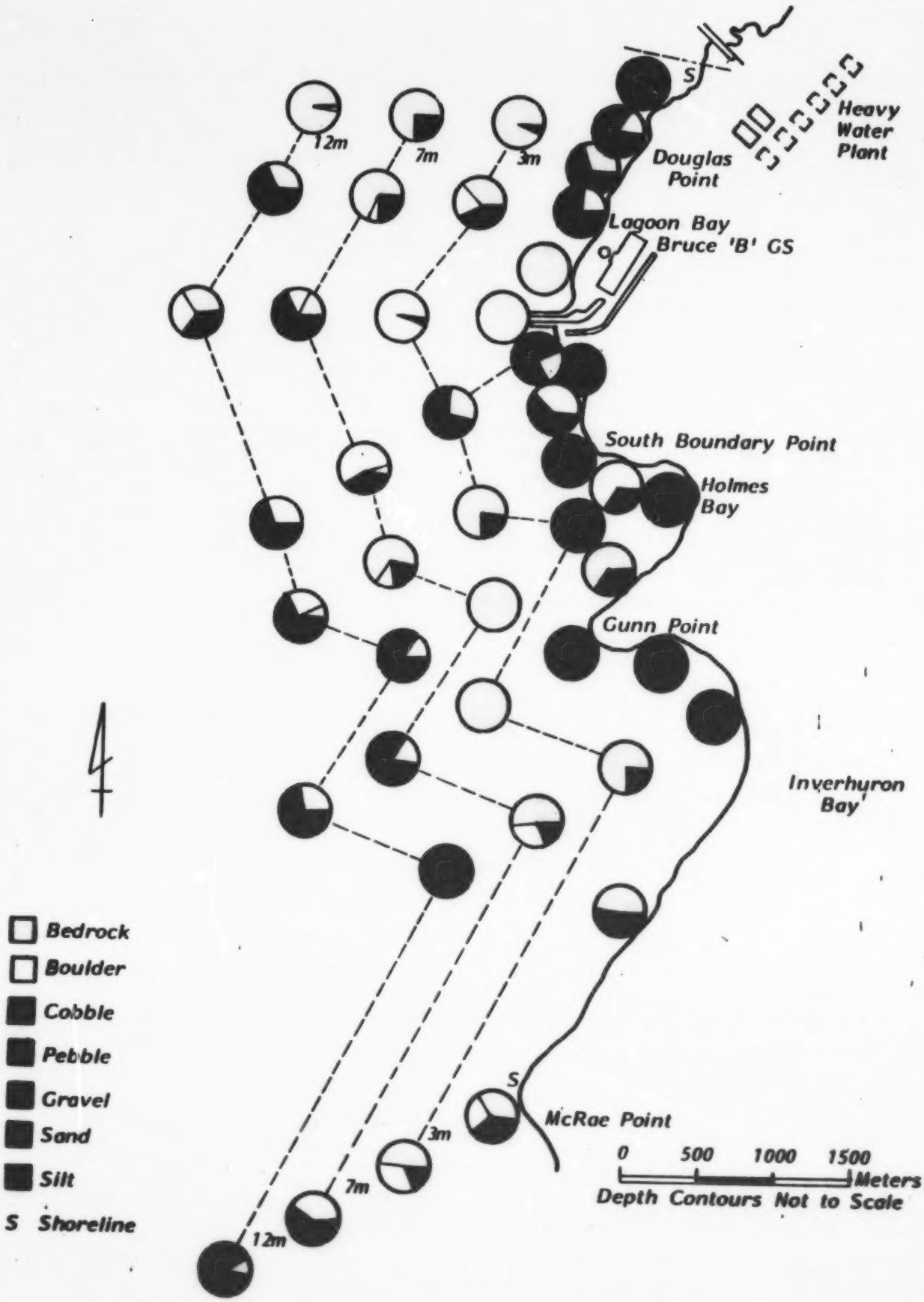
Substrate Percent Composition
Bruce GS 'B' - 1980

Location	Replicate	Shoreline						
		Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
McRae Pt to Inverhuron Bay	A	61		4	35			
	B			51	45	4		
	C	80		20				
	X	47		25	27	1		
Inverhuron Bay to Gunn Pt	A				15	85		
	B			15	15		70	
	C				5	5	90	
	X			5	12	30	53	
Gunn Pt to Holmes Bay	A	74						
	B	100		6	19	1		
	C	15						
	X	63		52	23			
Holmes Bay to South Boundary Rd	A			19	17	1		
	B		78	14	8			
	C		48	24	28			
	X		63	25	12			
			63	21	16			
South Boundary Rd to 'B' Intake	A							
	B		32	60	8			
	C		40	60				
	X		40	60				
			37	60	3			

APPENDIX A

Substrate Percent Composition
Bruce GS 'B' - 1980

Shoreline								
Location	Replicate	Bedrock	Boulder	Cobble	Pebble	Gravel	Sand	Silt
'B' Intake to 'B' Outfall	A				70	30		
	B			20	76	4		
	C			26	56	18		
	$\bar{X}$			15	68	17		
'B' Outfall to Lagoon Bay	A	100						
	B	100						
	C	100						
	$\bar{X}$	100						
Lagoon Bay to Douglas Pt	A			80	20			
	B	100						
	C			100				
	$\bar{X}$	33		60	7			
Douglas Pt to BHWP	A				95	5		
	B			34	54	12		
	C				29	71		
	$\bar{X}$			11	60	29		



APPENDIX B

MEAN SITE SUBSTRATE PERCENT COMPOSITION
BRUCE 'B' GS 1980

155588 RD

Annex IX

Sediment Grain Size (mm/cm / gm)
Series II '3' 13)

Intermittent Sedimentation

MAY - JULY

Depth Contour (m)	Douglas Point	Lagoon Bay	Bruce 'B' Discharge	Bruce 'B' Intake	South Boundary Point	Holmes Bay	Gunn Point	Inverhuron Bay	McRae Point	Depth Mean
3	0.0092	0.0077	0.0086	0.0104	0.0148	0.0128	0.0114	0.0267	0.0189	0.0134
7	*0.0043	0.0085	*0.0049	0.0080	0.0212	0.0152	0.0135	0.0243	0.0124	0.0147
12	0.0030	0.0051	0.0026	0.0029	0.0109	0.0300	0.0025	0.0043	0.0022	0.0071
Transect Means	0.0061	0.0071	0.0056	0.0071	0.0156	0.0193	0.0091	0.00184	0.0112	

JULY - SEPTEMBER

3	-	-	0.0383	0.0106	0.0052	0.0892	*0.0089	-	-	0.0368
7	-	*0.0496	-	0.1282	0.0533	0.4837	*0.1890	0.2448	0.2450	0.2310
12	*0.0269	0.0699	0.0253	-	0.3403	-	0.0317	0.1465	*0.0422	0.1227
Transect Means		0.0699	0.0318	0.0694	0.1329	0.2865	0.0317	0.1957	0.2450	

September-November

3	[illegible]	[illegible]	-	-	-	[illegible]	-	[illegible]	-	[illegible]
7	-	[illegible]	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]
Transect Means	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

* Not included in means. Tubes in sides or more than 45° angle.

Appendix 3

Sedimentation Rate (gm/cm^2/day)

Organic Sedimentation

MAY - JULY

Depth Contour (m)	Douglas Point	Lagoon Bay	Bruce 'E' Discharge	Bruce 'B' Intake	South Boundary Point	Holmes Bay	Gunn Point	Inverhuron Bay	McRae Point	Depth Mean
3	0.0060	0.0026	0.0011	0.0012	0.0061	0.0011	0.0012	0.0017	0.0022	0.0026
7	*0.0006	0.0011	*0.0006	0.0010	0.0104	0.0050	0.0011	0.0033	0.0013	0.0033
12	0.0003	0.0005	0.0003	0.0004	0.0005	0.0068	0.0003	0.0003	0.0002	0.0011
Transect Means	0.0032	0.0014	0.0007	0.0009	0.0057	0.0043	0.0009	0.0018	0.0012	

JULY - SEPTEMBER

3	-	-	0.0042	0.0008	0.0008	0.0132	*0.0003	-	-	0.0048
7	-	*0.0020	-	0.0058	0.0051	0.0079	*0.0038	0.0058	0.0060	0.0061
12	*0.0015	0.0049	0.0023	-	0.0068	-	0.0014	0.0031	*0.0018	0.0037
Transect Means		0.0049	0.0033	0.0033	0.0042	0.0106	0.0014	0.0045	0.0060	

September-November

3	[illegible]	0.0026	-	-	-	0.0004	-	0.0002	-	0.0011
7	-	0.0003	-	-	-	0.0004	0.0010	0.0004	0.0005	0.0005
12	0.0008	-	0.0009	0.0008	0.0005	0.0008	-	0.0003	0.0009	0.0007
Transect Mean	0.0007	0.0004	0.0009	0.0008	0.0005	0.0005	0.0010	0.0003	0.0007	

* Not included in means. Tubes on sides or more than 45° angle.

APPENDIX D

Mean Daily Water Temperatures

Bruce GS 'B' - 1980

THB - 04

DAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1		9.4	12.6	17.8	12.6	8.1	4.9
2	5.0	8.9	14.6	17.9	13.0	8.2	
3	5.4	8.3	13.7	14.2	11.8	8.7	
4	4.9	8.9	10.7	16.9	10.7	8.2	
5	4.5	8.6	11.7	18.6	11.8	8.6	
6	5.4	8.4	17.1	17.8	12.1	8.6	
7	5.4	8.7	16.1	11.5	12.3	8.4	
8	6.4	9.1	17.3	11.5	12.7	8.4	
9	6.8	9.1	13.6	18.9	11.0	8.3	
10	5.1	7.7	8.3	17.5	12.9	8.0	
11	5.1	9.1	5.4	16.3	12.5	8.1	
12	5.2	8.6	8.4	11.8	12.7	8.1	
13	7.2	7.2	10.1	14.6	12.6	8.2	
14	8.1	7.3	9.6	14.2	11.2	7.6	
15	8.4	11.7	9.5	9.2	12.6	7.2	
16	8.2	12.1	6.8	8.8	12.8	7.1	
17	8.7	11.5	7.2		12.8	7.2	
18	7.2	9.2	7.1		11.8	6.8	
19	6.7	9.3	8.3		11.6	6.6	
20	6.2	10.5	8.9		11.5	6.7	
21	6.6	15.6	8.8		11.3	6.7	
22	6.5	12.3	8.4		11.2	6.4	
23	8.5	11.1	9.7		9.5	5.9	
24	8.7	10.8	7.7	12.6	9.6	5.7	
25	8.6	10.2	7.2	10.2	10.4	5.4	
26	10.1	11.7	8.2	14.3	10.2	6.6	
27	7.8	11.8	11.3	13.7	9.6	6.5	
28	5.9	10.5	9.7	13.4	9.1	6.4	
29	6.8	11.8	9.2	12.8	9.0	5.2	
30	8.7	10.5	14.9	12.5	8.9	3.7	
31		11.3	16.8		8.8		
MN	6.7	9.8	10.2	14.2	11.2	7.2	
MIN	4.5	6.8	6.9	8.8	8.8	3.7	
MAX	10.1	15.6	17.3	19.6	13.0	9.2	

APPENDIX D

Mean Daily Water Temperatures

Bruce 35 'B' - 1980

THB - 08

DAY	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1		4.7	8.7	12.5	20.4	20.9	13.9	9.3	4.5
2		4.8	9.1	12.7	20.5	20.8	13.8	9.5	
3		7.5	9.2	13.6	20.4	21.5	13.7	8.8	
4		7.7	7.4	14.6	20.8	21.4	13.6	8.9	
5		8.3	7.1	14.9	21.2	21.7	12.7	9.5	
6		6.0	7.5	12.0	21.4	21.7	12.0	9.4	
7		6.4	7.4	15.0	21.9	21.8	12.1	9.5	
8		6.3	8.5	15.7	22.3	21.3	13.0	9.6	
9		7.1	8.8	14.2	21.9	20.9	13.8	9.4	
10		7.5	9.0	14.9	21.3	20.4	13.1	9.0	
11		7.4	8.4	15.9	21.0	19.8	13.0	9.0	
12		8.5	9.2	13.8	21.1	19.6	13.3	9.0	
13		8.0	10.8	14.1	20.9	18.9	13.2	7.9	
14		8.1	11.4	15.4	20.1	18.2	12.2	8.4	
15		8.8	11.2	16.8	20.8	18.4	11.7	8.1	
16		8.3	7.6	16.6	19.3	18.1	11.6	8.2	
17		8.5	8.2	17.4	14.0	18.4	11.5	8.3	
18		8.2	9.1	18.1	17.7	17.8	11.5	7.3	
19		6.5	9.7	19.2	19.5	14.3	11.2	7.0	
20		6.8	11.2	19.2	19.0	14.3	11.0	6.0	
21		7.0	8.9	19.5	19.3	14.8	11.6	5.4	
22		9.6	10.6	19.4	19.7	15.0	12.2	5.3	
23		9.5	12.1	18.9	19.1	16.9	10.8	4.3	
24	4.5	8.2	13.5	19.0	15.2	16.0	9.8	6.5	
25	6.1	8.0	14.5	19.4	17.7	15.8	9.8	8.6	
26	5.6	6.2	16.1	18.1	20.2	15.1	9.3	7.0	
27	4.6	5.7	12.9	19.1	20.8	14.5	9.2	7.1	
28	6.0	5.4	8.3	19.2	20.3	14.4	10.3	6.1	
29	5.4	5.5	11.4	19.5	20.4	13.6	9.8	5.9	
30	5.4	6.6	12.0	19.6	20.6	13.7	8.9	5.1	
31		8.6		20.1	20.7		8.3		
MN	5.1	6.4	9.9	16.7	19.7	17.4	11.7	7.7	
MIN	3.8	3.5	7.1	12.0	12.3	11.8	8.3	4.3	
MAX	6.0	9.5	16.3	20.1	22.3	21.8	13.9	9.6	

POOR

QUALITY

ORIGINAL